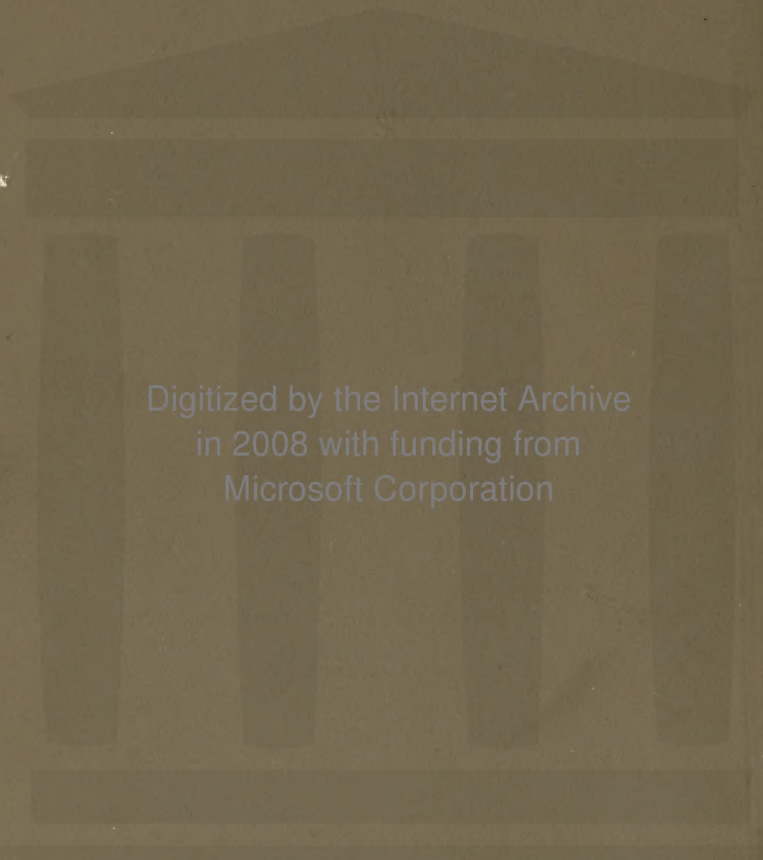
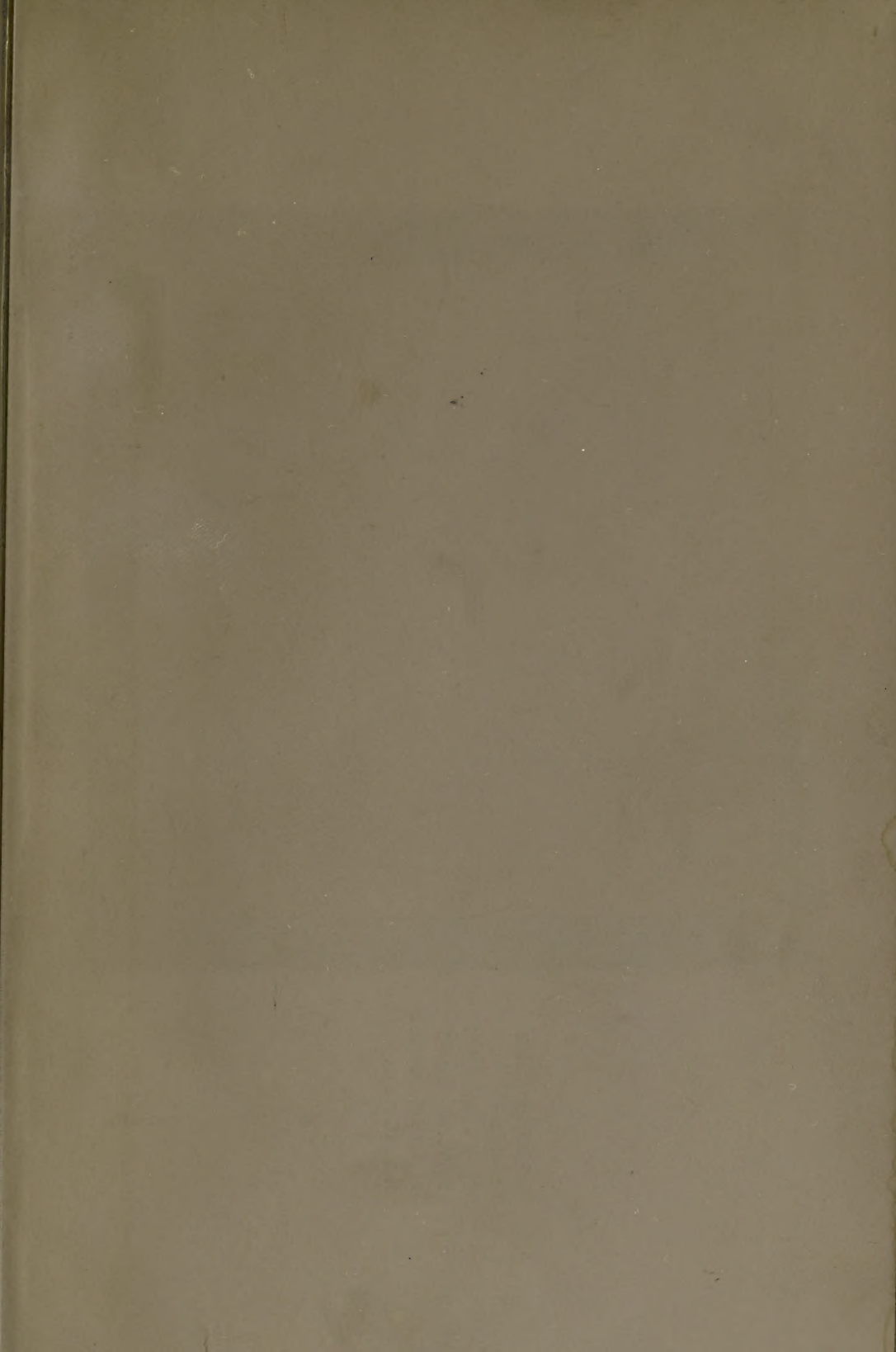


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DEGENERATIVE
CHANGES
INVOLVING THE
CENTRAL ZONE
OF THE CHOROID
AND RETINA.



RIGHT EYE.

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The Ophthalmic Year-Book

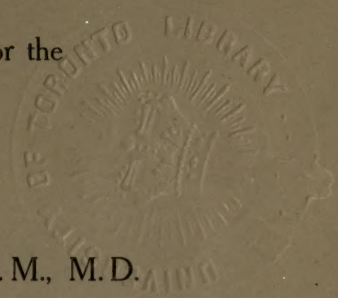
A Digest of the Literature of Ophthalmology

with

Index of Publications for the
Year 1903

BY

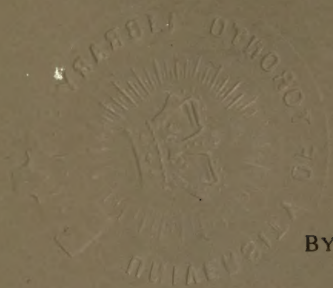
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Hospital, St. Anthony's Hospital, and Mercy Hospital, Denver, etc.

WITH FORTY-FIVE ILLUSTRATIONS

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Announcement

The literature bearing on ophthalmology grows by some 20,000 to 30,000 pages each year. Of this, one-third may claim to be original matter of some value. Its bulk renders necessary some plan of indexing or abstracting, to render it available for any practical use. Each progressive student, even tho he can command but a part of this literature, has been compelled to adopt some system of classification and expend much time and effort in carrying it out, if he would refer in the mass of books and periodicals to any particular fact or discussion wanted.

The need for a condensed account of the great bulk of literature causes almost every ophthalmic journal to include an abstract department. These abstracts are often of great value. But systematic arrangement of such material is essential to its highest usefulness; and this it is impossible to obtain in a monthly, or even in a quarterly journal. The year-book has a great advantage in this respect.

The attempt is here made to furnish two things: First, a critical digest of the most important literature of the past year, judging it from the standpoint of the ophthalmic surgeon. Not extracts or an outline of that literature; but the important things, given sufficiently in detail to make them applicable in practice. Second, a list of the more important original communications appearing during the year. The design is to help the practitioner in this branch to keep up with the progress of his specialty; and with this to supply a series of volumes which will bring him in touch with all the more important recent communications upon any subject.

The point of view from which the literature is here approached renders it unnecessary to notice many articles, which bring to the attention of the profession at large facts and views already found in ophthalmic literature. These

articles published chiefly in general medical journals may be of the highest benefit to a large proportion of their readers; but they require no notice in this work. Then many reports of single cases, altho important enough to be permanently recorded, may not be noticed except in the index, unless they supplement some more general study of the subject.

Let it be clearly understood that there is no implication that papers on ophthalmic subjects not mentioned in these pages, are without value; merely that they are judged not to serve the purpose here in view. The value of a work like this depends, largely, upon its exclusion of all but the most appropriate matter.

To use such a book as this to advantage, the reader must become acquainted with its arrangement. Some little time spent in studying it, merely as a book, will be profitable. Its index should receive special attention. Through this index it is hoped to render promptly available all that is in the year-book; and through the year-book all the most important matters in current ophthalmic literature.

In the proof reading and revision of this volume, valuable assistance has been received from my friends, Drs. E. W. Stevens and G. F. Libby.

EDWARD JACKSON.

DENVER,

MAY 25, 1904.

Digest of the Literature

Refraction

CHOICE OF TERMS.—The development of a new science necessitates a corresponding growth in language. In ophthalmology time has not yet elapsed to fix absolutely the word that should be used to express a certain idea. In the end common usage is supreme as to the meaning of words. Until it can settle disputed questions our choice must be guided by such things as definiteness, priority, brevity, euphony, correspondence in form to words of the same class already in use, and appropriateness of derivation.

In the original coining of words, derivation should be very carefully considered; but brevity, euphony, and correspondence to other terms of the kind are of more practical value; and when once usage has given the word a meaning of its own, derivation loses most of its importance. At best, a new word can give but a mangled and incomplete picture of the meanings that its root words possess; to give anything more would extend every new term to the dimensions of the sentence-long-compound-words sometimes indulged in by German writers.

As it is, the attempt to express a new idea by grouping together several old ones in the forming of a new term, is more apt to lead to controversy than to clearness. This has been illustrated in the past year in an argument by Suker for the employment of certain terms; and in the criticism and counter-argument brought forth by Suter and Claiborne. The whole controversy deals with questions of derivation. Brevity, euphony and the other virtues a word may have, give little ground for dispute.

Suker accepts anisometropia as signifying an unequal

amount or degree of the same kind of refraction error; and antimetropia as meaning a different kind of refraction in the two eyes. But he suggests that heterometropia would express the latter meaning better. He would have brachymetropia or hypometropia displace myopia, because they correspond in derivation with emmetropia. For the same reason, hypermetropia is thought better than hyperopia.

Suter, instead of giving them opposing definitions, would make antimetropia a special form of anisometropia. He adheres to myopia because of its simplicity and established place in the language; and he does not find that hypermetropia can show an essentially better derivation than the shorter hyperopia.

Claiborne, also, finds plenty of room for discussion as to the root meaning of hypermetropia; and he rejects antimetropia because anti means opposition, not oppositeness or difference. Burnett in discussing astigmatism and astigmia urges that derivative meaning as well as brevity and euphony, favors the latter term.

Donders, when he suggested the term brachymetropia, said: "It appears preferable to use the word myopia," and continued to use it; and although he gave his adhesion to hypermetropia and astigmatism, he habitually used instead their initial letters, H. and A. This building up of an elaborate word and then using something more convenient to stand for it illustrates the absurdity of basing a term intended to have a meaning of its own simply upon a supposed appropriate derivation.

The writer, while favorably disposed toward the word *astigmia*, has been unwilling to adopt it unless it found sufficient favor with others to render probable its general use. This seems now to be assured. The French equivalent "*astigmie*" has certainly been growing in favor, and at least one English journal has given official sanction to the shorter word. It will be used throughout the following pages.

Anisometropia will always have in practical use a somewhat indefinite significance. At best, it is used to designate

a condition with variable limits. We do not in practice speak of eyes as anisometropic when they differ but slightly in refraction; if we did so nearly all our refraction cases would be cases of anisometropia. Nor can we set a limit, as 1. D., above which the term should be applied, while for smaller differences it should not. Such a difference would in one case give rise to those phenomena which require the use of this special term; while in other cases it would not. Neither is difference of refraction an essentially different thing when the two eyes happen to fall on opposite sides of emmetropia, from what it is when both are hyperopic or myopic. As to hyperopia and myopia, usage has given them perfectly definite meanings; while brevity and euphony will in the end outweigh any particular theory of derivation.

TESTS OF REFRACTION

THE STYLET AND TRIANGLE.—The Schreiner experiment has for two generations been the prolific source of subjective methods of measuring refraction, and it still seems unexhausted. One of the latest and best is the *method proposed by Van den Bergh*. In the original experiment light is admitted to the pupil through two pin holes. If the eye be focused for the source of light single vision results; otherwise each pin-hole gives its separate image on the retina. The distance between these images increases with the distance of the retina from the posterior focus of the dioptric media (that is with the uncorrected ametropia); and, also, with the distance between the pin-holes. Van den Bergh, in place of the pin-holes, uses larger lateral areas of the pupil which are separated from one another by holding in front of the eye a stylet, such as a Bowman probe. Instead of a point of light, he has the patient look at a triangle like that shown in Fig. 1.

The stylet is held parallel to the line joining the apex of the triangle with the middle of its base. The whole triangle is placed on a dead black ground. When looked at by an em-

metropic eye, or one with corrected ametropia, the triangle appears as in Fig. 1, with a sharp outline. Holding the stylet in front of the eye does not alter this appearance.

To an eye with uncorrected ametropia, however, the triangle appears hazy in outline; and on holding the stylet in front of the middle of the pupil there appears a smaller triangle of black projecting downward and dividing the original white area into two which are separated laterally but overlap at the base. See Fig. 2. The distance that the black triangle extends downward or the amount of separation of the



Fig. 1

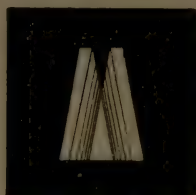


Fig. 2



Fig. 3

two white triangles, depends upon the amount of uncorrected ametropia, and upon the width of the stylet before the pupil.

The ametropia causing this lateral separation of the triangles is the ametropia of the meridian perpendicular to the stylet. By giving the triangle and the stylet the appropriate direction the ametropia can be measured in any desired meridian.

The dimensions of the triangle chosen by Van den Bergh are a base of 12 c.m., and a height of 50 c.m. With this placed at a distance of 5 meters, and using a stylet 1 m.m. in diameter, the separation of the two white triangles by the black one is just complete with 20 D. of ametropia. Each 2.5 c.m. that the black triangle projects downward between the two white ones represents 1 D. of ametropia. If, however, a 4 m.m. stylet be used each 2.5 c.m. of the black triangle represents 0.25 D. of ametropia. As a scale to indicate the length of the black triangle, projecting arms 5 m.m. wide are placed 20 m.m. apart. See Fig. 3.

This test is one of great delicacy. Under favorable circumstances, using a stylet as broad as can be used with the undilated pupil (2 to 4 m.m.) it is easy to recognize and measure, in one's own eye, less than 0.25 D. of ametropia. But such a broad stylet must be held very accurately before the eye; and then it tests the refraction in the extreme periphery of the pupil, not at the center. This defect and the difficulty of teaching a patient how and what to observe, will prevent this test from coming into general practical use. But for exceptional cases it is a distinct addition to our resources.

The term "subjective skiascopy" is suggested for this test with some show of reason, but as a matter of fact all subjective tests for errors of refraction depend on shadows of some sort upon the retina. With quite as much reason one might speak of the use of test-letters and test-lenses as subjective skiascopy.

KINESCOPY more closely resembles skiascopy than does the preceding test. It depends on moving a small opening in front of the pupil while the eye is fixed on a small distant object. This causes apparent movement of the object looked at, when the rays from it are not accurately focused on the retina; but allows the object to appear stationary when the rays are perfectly focused. Holth, who worked this out as a practical method, has brought together many allusions to the phenomenon upon which the test is based, from earlier ophthalmic literature, and he again urges its value. It will be found a valuable subjective test for eyes so amblyopic that they do not perceive any effect from a change of 1 D. in the trial lens.

AMETROPOMETER.—This instrument, also founded on Schreiner's experiment, has been perfected by Fromaget. He employs a lantern giving an especially brilliant light, and before each of the holes of the Schreiner disk places a colored glass, one red, the other green. The luminous opening of the lantern is rectangular in form, its width being variable. The plate carrying this luminous opening is capable of rotation to any meridian.

The principal meridians of astigmatism are ascertained by placing before the eye a disk with pin-hole openings arranged in the form of a cross. Each of these openings gives an elongated image; and when the cross is turned so that one arm takes the direction of greatest elongation, it indicates the meridian of greatest ametropia. The slit aperture of the lantern is then turned to one of the principal meridians and the line joining the pin-hole openings of the Schreiner disk is placed perpendicular to it. Until the ametropia of this meridian is corrected, a red and a green image of the light are seen, homonymous for myopia and crossed for hyperopia. Lenses are placed before the eye until these two images fuse into a single rectangle of light. The lens doing this corrects the ametropia of that meridian.

To measure hyperopia or myopia without astigmatism, the lantern aperture may be placed in any meridian and the two images brought together by lenses. Even for astigmatism only spherical lenses are required, and Fromaget has employed for the purpose the lens disk of Kalt's ophthalmoscope.

This is a good subjective method for children, illiterates and those who do not possess, or will not acknowledge good acuteness of vision. But like others based on the Schreiner experiment it really measures the refraction of only two points in each principal meridian. If the error of refraction were capable of complete correction by a spherical or a spherocylindrical lens, the method would be theoretically and practically perfect. But the fact is, that in all eyes we find aberration and astigmatism. The actual refraction of the eye does not conform to the theory, and for that reason such methods must always be inferior to those, like skiascopy and the trial lenses, which deal to some extent with the refraction in all parts of the pupil.

SKIASCOPY.—The optical theory of skiascopy has been pretty thoroughly worked out. Wolff's monograph and Broca's article add little of importance. A good demonstration of it has been based by Burnett on the laws of

conjugate foci. But the practical bearings and importance of many points theoretically demonstrated are not yet appreciated. Duane finds that in making the test *cylinders* are not used as much as they should be. He advocates their routine use "as enabling us to determine with the utmost precision (a) the amount of astigmatism, (b) the axis of astigmatism, and (c) the exact spherical correction." Nineteen years ago I urged that in measuring astigmatism, the final test should always be made with the correcting cylinder before the eye; and since have repeatedly described that part of the test in detail. Others have been equally emphatic on this point, but Duane is undoubtedly right in thinking that further positive testimony on the subject is needed.

Duane also says that "it is essential for the observer to get in the habit of constantly *varying the distance* from the patient." He urges this with reference to the test as applied with the concave mirror, with which the latitude of movement is much less than with the plane mirror. An arrangement by which a series of lenses may be brought successively before the eye, as with the "Double Hand Skiascope" of Jennings, may be a great help; but it cannot replace the movement of the observer toward or from the patient's eye.

The difficulty with skiascopy seems to be that its reliability and accuracy have been called in question by those who have practiced it without attention to the conditions upon which its accuracy necessarily depends. One essential is that the surgeon shall get near enough to the patient to see what changes of light and shadow really occur in the small central part of the pupil that is commonly employed for accurate vision. Only in this way can we exclude the errors due to the irregular astigmatism and aberration that exist in all eyes. I have proposed, in contradistinction to the loose shadow testing, which even the opticians now claim to practice, to designate as "*exact skiascopy*": The working at a distance of one-quarter to one-half meter; the accurate measurement of the distance; the adaptation of the source of light and sight-

hole to this distance; care to bring the source of light close to the conjugate focus of the retina; means of fixing exactly the direction of the principal meridians; control testing, by departure both ways from the lens' strength, focal distance, or meridian fixed on; and, in general, precision and exactness in every detail.

Practiced with the proper attention to detail, skiascopy is more reliable than any other single method of measuring refraction. Of course to habitually practice it in that way, one must believe that the accurate measurement of refraction is important enough to justify some labor in attaining it.

EYE STRAIN

NERVOUS SYMPTOMS.—The importance of eye strain in causing headache and a long train of other nervous ills, is understood among ophthalmologists. Still, new evidence of it is not wasted, for one needs to have his faith in this relation pretty strong, to keep him always up to the effort of tracing out and correcting accurately the causative error of refraction.

Gould deserves the thanks of the ophthalmologist for seeking out and bringing together an array of facts relating to the ill-health of eminent men and women that, at least, might have been due to eye-strain. He has demonstrated that some of the eminent persons whose maladies he has discussed suffered from symptoms more likely to be due to eye-strain than any other known cause. He is right, also, in saying that such sufferers should have the benefit of the most careful and intelligent efforts to remove or exclude eye-strain. And this should be undertaken, not as a forlorn hope, when years of suffering and ineffective treatment have established the habit of pain; but as the first step in the rational management of the case. Gould, by ignoring other factors, in his special pleading of the importance of eye-strain, may have lessened the scientific value of his writings. But this is no justification for ignoring the important truth

that they do illustrate and emphasize. It may be that violent statement and excessive claims are necessary to break the conspiracy of silence, or of insignificant reference, that may be observed in works on general medicine, toward the effects of eye-strain.

Each ophthalmic surgeon should help inform the general profession as to the importance of this matter. But in his own practice he may need to keep more constantly in mind the "mimicries of eye-strain." De Schweinitz points out that many of these arise from defects of metabolism, such as make the "gouty diathesis." Also that the symptoms may depend upon the presence of a point of tenderness in the ciliary region, or arise as symptoms of neurasthenia, or hysteria, or from subnormal accommodative endurance due to constitutional conditions.

ASTHENOPIA NOT DUE TO AMETROPIA.—Gradle calls attention to the fact that asthenopia may be partly or wholly dependent upon neurasthenia or hysteria. He finds that neurasthenia or anemia may cause symptoms to arise from a degree of ametropia so low that it would pass unnoticed in a healthy person of similar age. Or the symptoms may be a great exaggeration of what might be expected from the degree of ametropia, or they may continue for a long time after the cessation of close eye work. Gradle finds that in 20 to 25 per cent of his cases the asthenopia is not caused by any error of refraction or insufficiency of accommodation. Hysteria or psychic influences he has traced in 5 per cent of his cases. He thinks many persons, otherwise normal, can create or perpetuate distressing sensations by concentrating attention upon some part of the body. It would be more accurate to speak of such asthenopia as of psychic origin, rather than hysterical.

It must not be forgotten that eye-strain may cause asthenopia in perfectly normal eyes, working too much or under unfavorable conditions. Bardes mentions the excessive use by insufficient illumination that is common among the dwellers in cities. These factors, combined with others that im-

pair nutrition and especially tax the nervous system, may well account for cases of *asthenopia* not connected with ametropia. These excellent explanations of *asthenopia* not due to ametropia, however, must not lead us to assume that the eyes are not ametropic unless that fact is demonstrated by careful measurement under cycloplegia. As Gould points out many eyes have been pronounced perfect that were ametropic, and their *asthenopia* afterwards relieved by correcting lenses. He who does not habitually employ cycloplegics is not likely to detect the errors of this kind that he may make.

RELIEF BY LENSES.—The first three of Gould's "Sixty-Eight Reasons Why Glasses Did Not Give Relief" are: (1) The patient's complaint may not be caused by eye-strain; (2) intercurrent disease, etc., may hinder the cure; and (3) stopping the cause does not always stop the morbid effect. The other sixty-five are substantially that, for various reasons, the patient does not have the proper glasses. In a statistical study of the connection of *eye-strain* and *headache*, Zimmerman found that the correction of the optical error in 794 cases gave the following results: Cured, 684; improved, 90; not improved, 20. Zimmerman used a cycloplegic in more than 99 per cent of his cases which were under 40 years of age.

The location of the headache is given in 428 cases. In 279 it was frontal; in 77 it was frontal and also occipital, temporal, vertical or general, the frequency being in the order named. In 16 it was occipital; and in 11 situated in the occiput and elsewhere; in 13 vertical; in 12 temporal; and in 13 merely general.

Zimmerman also reports 21 cases of other disturbances due to eye-strain. These include epileptiform attacks, 2; vertigo, 9; shoulder pain, 2; blepharospasm, 3; and 1 each of abnormal head position, chorea of the lids, somnolence, abdominal pain and insomnia. Of these cases, 10 were known to have been cured by glasses, the others having failed to report. A class of cases in which choreic movements are closely associated with eye-strain, is noted by Baker.

Possibly these are not true choreas, but they are met frequently, and often not treated intelligently. He finds them relieved by correcting glasses.

CYCLOPLEGICS

USE AFTER FORTY-FIVE.—Starkey made a collective investigation as to the practice of American oculists with regard to the use of cycloplegics after the age of 45. He finds that no age can be arbitrarily fixed beyond which cycloplegics must not be used. Although in certain cases they are as necessary after 45 as before, they are required in fewer and fewer cases as life advances. Griffin reports three cases ranging in age from 49 to 66 years, in which the use of homatropin was necessary to determine accurately the error of refraction. He believes the cycloplegic may be frequently employed with profit in the testing of ametropic presbyopes.

CYCLOPLEGIA WITHOUT MYDRIASIS.—A case of apparent cycloplegia by homatropin and atropin without mydriasis is reported by Phillips. The solution of homatropin used was 5 gr. to the fluid ounce, with the addition of one-half that quantity of cocain. It produced the ordinary mydriasis upon other patients. The atropin was in 2 per cent solution, and when tested upon others showed its ordinary physiologic action. These solutions were repeatedly instilled, but the pupils continued to react freely to light. In direct sunlight the patient was able to see the finest print, but in a room which was rather dark, she was hardly able to see faces. Failure of the pupils to dilate under a mydriatic is not very rare, but almost invariably they lose the power of reacting to light, or with convergence. Apparently in this case the drugs produced their ordinary effect on the ciliary body, but failed to disturb the action of the iris. Eighteen months later the patient showed the same idiosyncrasy, although not to such a striking degree.

CHANGES IN REFRACTION.—Risley formerly believed that the static refraction of an eye did not change except in the

presence of certain pathologic conditions. But while still believing that this is the rule he is convinced that numerous exceptions occur. He reports four striking cases as examples of such changes involving the direction and amount of astigmatism occurring quite apart from the alterations which attend progressive distension of the globe. He makes the practical application of this fact, that a manifest inaccuracy in the glasses worn should not be ascribed simply to lack of care in the previous measurement.

In discussing Risley's paper, Thorington mentioned a case in which the refraction had become respectively 2.25 D., and 6 D. more myopic in a diabetic patient, aged 68. The rapidity with which such changes may occur in connection with diabetes is illustrated by a case reported by Alexander. A man aged 57 complained that for a fortnight he could not see at a distance, and that his near glasses no longer suited him. He was found to have myopia of 1 D., the correction of which gave him full vision. His urine contained 5.7 per cent of sugar. He was placed on treatment for diabetes. Eight days later he reported that he could see perfectly without glasses for distance; and that his former glasses for near work were again useful. The urine was now free from sugar. Five days after that his required correcting lenses were found to be:

$$\begin{array}{l} R.=6/60+1.75 \text{ with } +\text{cyl. } 0.50=6/5 \\ L.=6/60+1.75 \text{ D. } =6/5 \end{array}$$

For reading he required +4 D. Sph. The urine remained free from sugar. It would be very interesting to learn how such changes in refraction are produced in so short a time. When the opportunity presents, such a case ought to be thoroughly studied. For up to the present time we have only theoretical discussions of how such changes might be produced.

DIFFERENT STATES OF REFRACTION CO-EXISTING IN THE SAME EYE.—From the changes that may occur in the refraction of the eye we must sharply separate those permanent differences of refraction exhibited by different parts of the pupil.

In 1888 before the American Ophthalmological Society, and in 1894 before the Ophthalmic Section of the American Medical Association, I pointed out that such differences of refraction are to be found in all eyes where the pupil is dilated, and in many eyes in its condition of ordinary contraction. The differences are greatest in conical cornea, and in the myopia or lowered hyperopia which comes on before nuclear cataract.

In most eyes only one portion of the pupil is capable of affording good vision, so that with subjective tests the refraction of other parts is ignored; the different states of refraction in question being only revealed by skiascopy, the refraction ophthalmoscope or the ophthalmometer. In a few cases, however, the vision is almost equally good with the totally different correcting lenses required by different areas in the pupil.

A striking collection of cases of this sort has been made by Szily of Budapest. Among 30,328 eye patients seen in four years he has encountered sixteen cases of the kind. He tested them by the use of a stenopaic aperture of 2 or 3 m.m. diameter, placed before different portions of the dilated pupil; and also by covering the central portion of the pupil by a disk 4 m.m. in diameter. Some of his cases are quite striking, as where he obtained 6/20 (?) vision through the periphery of the pupil with —1.D., and 6/20 through the center of the pupil with —15.D. lens. Szily entitles his paper "The Lens With Double Focus," and devotes a good deal of it to the discussion of posterior lenticonus. But a reading of his cases indicates that some of them were clearly cases of conical cornea; and most of the others were cases of altered refraction preceding nuclear cataract.

The common tendency to speculate and argue, rather than to observe facts, is illustrated by a discussion opened by Schoute, of the connection between illumination and refraction. In my original paper I pointed out that positive aberration (relative myopia in the periphery of the pupil) was the most common refractive variation between different

parts of the pupillary area; and said: "It would appear that in dim light it is of more importance to utilize a large proportion of the rays entering the dilated pupil than to secure accuracy of focus for those entering the central portion. This makes the eye, when the aberration is positive, less hyperopic or more myopic by a dim light." This observation as to aberration in the dilated pupil is easily made, and has been repeated in thousands of cases. Yet Schoute, and those who discussed his paper, gravely considered the hypothesis of Charpentier, viz., that strong illumination causes swelling of the choroidal veins, pushing forward the retina, and thus rendering the eye less myopic in a strong light. While, according to the account, Prof. Snellen, Jr., thought "that as the seeing in twilight costs much exertion, this could mean a contraction of the external ocular muscles, which contract and lengthen the bulb." Motais' observation that typographers are often 0.50 D. more myopic in the evening than in the morning, doubtless refers to a different phenomenon, a real change in the eye; and his explanation by spasm of accommodation is probably correct.

PERISCOPIC LENSES.—Percival, having in a former paper neglected to allow for the axial thickness of strong convex lenses, has revised his calculations in that respect; and gives the following table of curves for the best periscopic lens; based on an index of refraction 1.54 for the spectacle glass used:

SURFACES FOR PERISCOPIC LENSES.

LENS STRENGTH	CONVEX		CONCAVE	
	ANTERIOR SURFACE	POSTERIOR SURFACE	ANTERIOR SURFACE	POSTERIOR SURFACE
1. D.	+ 6. D.	— 5. D.	+5.5 D.	— 6.5 D.
2. D.	+ 8. D.	— 6. D.	+5. D.	— 7. D.
3. D.	+10. D.	— 7. D.	+4.5 D.	— 7.5 D.
4. D.	+12. D.	— 8. D.	+4. D.	— 8. D.
5. D.	+13. D.	— 8. D.	+3.5 D.	— 8.5 D.
6. D.	+15. D.	— 9. D.	+3. D.	— 9. D.
7. D.	+16.5 D.	— 9.5 D.	+2.5 D.	— 9.5 D.
8. D.	+17.75 D.	— 9.75 D.	+2. D.	—10. D.
9. D.	+19.5 D.	—10.5 D.	+1. D.	—10. D.
10. D.	+21. D.	—11. D.	Plane	—10. D.
12. D.	+23. D.	—11. D.	Plane	—12. D.
14. D.			Plane	—14. D.
15. D.	+27. D.	—12. D.		
16. D.			— .5 D.	—15.5 D.

By means of the above, any one who can command the service of a complete lens grinding plant, can prescribe truly periscopic lenses. The American so-called "periscopic lens" has always one surface ground to 1.25 D. of the opposite curve. An inspection of the above table shows how far this is from the truly periscopic lens. The French custom of using a 4.25 D. opposite curve is just as practical, and comes very much nearer to the true periscopic standard for the lenses which are most frequently prescribed. There seems to be no good reason why the lenses carried in stock by opticians should not conform to a better standard.

CHANGE OF REFRACTION BY REMOVAL OF LENS.—The optical effects of removal of the crystalline lens, either for cataract or high myopia, vary so greatly in different cases that the prognosis of refraction based upon the schematic, or supposed average eye, cannot be very definite. The variations in corneal curvature, which are so easily read off from the ophthalmometer, and the variations in the depth of the anterior chamber and refractive value of the lens, for the determination of which practical methods might be worked out, are the factors which prevent reliance on deductions from the schematic eye.

Bjerke has grappled with some of these factors of variation, and furnishes elaborate tables showing the influence of the depth of the anterior chamber upon the refractive conditions of eyes, in which the refractive value of the crystalline varies from 14 D. to 19.75 D.; and the refractive value of the cornea from 50 D. to 38 D. The effect of variations in the corneal curvature is shown in the following table condensed from Bjerke's. The first line gives the refractive power of the cornea in dioptries; the second the radius of corneal curvature; and the third line the posterior focal distance in millimeters, that is, the distance of the retina behind the summit of the cornea, for an eye that would be emmetropic after the removal of the crystalline.

TABLE SHOWING LENGTHS OF APHAKIC EYE.

Refraction, D.	50	48	46	44	42	40	38
Radius, m.m..	6.73	7.01	7.31	7.65	8.01	8.41	8.85
Length m.m..	26.73	27.84	29.03	30.38	31.81	33.42	35.15

As a matter of fact corneal refraction varies beyond the limits of 38 and 50 D. I have seen high myopia with a corneal radius of less than 6.7 m.m. Let me again urge that the corneal radius should always be taken into account in deciding as to the removal of the lens for myopia. One may meet an eye myopic 15.D. that will remain myopic after the removal of the crystalline; or he may meet one myopic 30 D. that will be rendered hyperopic by the same operation. This possible variation is too great to be ignored.

CHANGE IN VISUAL ACUTENESS BY REMOVAL OF LENS.—It is fortunate for both patient and surgeon that the size of the retinal image is always increased by the removal of the crystalline lens. The weakening of the concave lens, or the strengthening of the convex required, improves the patient's vision. Bjerke concludes that to show the approximate effect on the acuteness of vision of correcting lenses placed 15 m.m. in front of the apex of the cornea, an addition or subtraction must be made of 2 per cent for each diopter of refractive power. Thus, the myope who required -20 .D. lenses may expect from removal of the crystalline, if it render him emmetropic, an improvement of 40 per cent in acuteness of vision; while the surgeon whose patient requires $+10$.D. lens after cataract extraction may count on 20 per cent improvement of vision, to help out the result of the operation.

MYOPIA

OPERATIVE TREATMENT.—Bjerke in a separate paper considers the influence of the curvature of the cornea and the distance between it and the lens, upon the refractive value of the lens in regard to myopia operations. He points out that any formula which ignores the distance between the anterior and posterior nodal points of the lens will lead to some error.

But while this error will amount to almost 0.5 D. for the emmetropic eye, it becomes insignificant in very high myopia. His most important practical conclusion is, that when those who operate on large numbers of cases of high myopia shall regularly compute the refractive value of the lens extracted, as they can do if they will make the proper observations before and after removing the lens, there will result a great gain to physiologic optics.

Frost brings out clearly and emphasizes the important point that the effect of the removal of the lens increases so rapidly with increase in the length of the eye-ball, that all very high degrees of axial myopia are approximately corrected by the operation. This he illustrates by the following table. The first column gives the lens required to correct the myopia, such lens being placed 10 m.m. in front of the cornea. It is common to express the degrees of myopia by such a lens, but the actual myopia as measured at the cornea would always be less than this. It is shown in the second column. The third column gives the lens required to correct the refraction after the removal of the crystalline.

EFFECT OF REMOVING LENS.

Lens Required Before Operation.	Actual Myopia.	Lens Required After Operation.
-12 D.	10.7 D.	+3.4 D.
-15 D.	13.0 D.	+2.8 D.
-20 D.	16.6 D.	+2.4 D.
-25 D.	20. D.	+1.1 D.
-30 D.	23 D.	+0.44 D.

To find the lens required after operation, Frost uses the plan of Percival. The actual myopia (2nd Column) is divided by 3, and the quotient added to 22.8 m.m., the normal length of the eye-ball. This gives the length of this particular myopic eye-ball. Subtract this length from 31 m.m., the length of the eye-ball which would be emmetropic after the removal of the crystalline. The remainder divided by 1.38 gives the correcting lens that will be required. Of course this plan assumes that the myopia is entirely axial, and

that the dimensions of the eye are those of the schematic eye. As has been pointed out above, these assumptions differ so frequently and so widely from the facts, that this plan has no scientific value, and will often be found misleading for practical purposes.

As a ready means of eliminating cases in which the question of operation need not be considered, Frost tests the ability to read the finest print, Jaeger 1. If this can be read much beyond 3 inches, the myopia is too low to be greatly benefited by operation. If it cannot be read at all, the function of the retina has been so impaired that operation could not yield a good result. Such a test is useful for making a provisional diagnosis. But it should never be allowed to decide the question of so important an operation. It ignores the differences between myopia of curvature and axial myopia, above alluded to, and it equally neglects the ability to wear correcting lenses. Concave lenses of 20 D., and stronger, can be worn with comfort; and give most of the benefits to be conferred by extraction of the clear lens, with the added advantage of accommodation.

So generally can correcting lenses be made to give relief in high myopia that in the last 5 years of practice I have felt justified in advising removal of the clear lens in but 4 cases. Wurdemann and Black, among 43 cases of myopia of 10 D. and upwards, report 3 cases upon which they operated; while in 37 cases, glasses more or less fully correcting the myopia were worn; and in 3, neither glasses nor operation could have been of much benefit.

METHODS OF OPERATION.—The last mentioned writers began with discission, subsequently extracting the lens when it was found to have a hard nucleus. In the discussion of their paper the importance of beginning with a small discission was generally agreed upon. On the other hand, Bronner thinks most surgeons perform discission and remove as much as possible of the lens matter at the same time. Basso cuts up the lens as much as possible with a Knapp's knife

needle, then makes a corneal section and extracts usually about two-thirds of the lens matter.

It cannot be denied that the latter methods shorten the period required for complete removal. But this is a consideration that should weigh very little against the greater safety of commencing with a very small discission, and, in the absence of a firm nucleus, relying upon repeated discissions to complete the removal. I believe it is much safer to begin with a regular extraction operation, making a linear capsulotomy so as to leave the retained cortex within the capsule, than it is to begin with a free discission. After any discission one should be prepared to do extraction promptly, if the indications for it arise. The presence of unaltered lens matter in the anterior chamber is the special danger to be guarded against in this operation.

OPERATIVE RISKS.—As to the danger of retinal detachment following myopia operations, Hertel found in his statistics of 6863 myopic eyes that retinal detachment occurred in about 1 per cent. But in eyes having 10.D or upward of myopia, without operation, 2.7 per cent showed detachment of the retina. His cases included 34 of extraction of the lens for high myopia; and among these, 4 suffered from retinal detachment. That is, detachment was approximately 3 times as frequent among those operated upon, as it was among those having presumably the same degree of myopia upon whom operation had not been done. Bronner reports 2 cases of detachment following 40 operations. Frost's experience was less favorable. He had 7 detachments after 33 lens removals. Taking all these together, we find that in 107 eyes, 13 subsequently suffered detachment of the retina, a little over 12 per cent. Comparing this with Hertel's statistics it would appear that detachment is about four times as likely to occur after the extraction of the crystalline lens, as in similar cases without extraction.

But retinal detachment is not the only risk attending the operation. Frost, in his 31 cases (33 eyes), besides detachments had 2 which suppurated; 1 that developed glaucoma;

and 1 of serous cyclitis with punctate opacities of the cornea; besides a case in which choroiditis at the macula prevented a good result. It should be noted that Frost believes "that the lens may be needled pretty freely at the first sitting, and a week or ten days later the lens matter may be evacuated."

MYOPIA, STATISTICS AND COMPLICATIONS.—Hertel's statistics (gathered at Jena) bring out many points of interest. He finds myopia to be the refractive condition in 31 per cent of the eyes he has seen. It is slightly more common among men than women. Among country people he has found 21 per cent myopic; among artisans 26 per cent; and among students almost 52 per cent. Accompanying choroidal changes were about twice as common among women as among men.

Senn, from a study of myopic eyes with regard to astigmatism and lesions of the center of the choroid, finds that these choroidal changes, which most seriously threaten the vision of the myopic eye, are much more common in the eyes that are also astigmatic; and that their frequency increases with the degree of the astigmatism. He urges for prophylaxis the early correction of the astigmatism. Where the central choroidal lesions are already present they are to be treated by the exact correction of astigmatism and subconjunctival injections of oxychlorid of mercury. In support of the latter measure he gives a table of 42 cases in which the average acuteness of vision before such treatment was 0.30 and after treatment 0.69.

The comparison of myopic distension of the eye-ball with glaucoma has often been made. Kampherstein reports 2 cases of glaucomatous excavation of the sclera in the region of the conus, in highly myopic eyes; Wintersteiner reports a case in which, with myopic distension of the eye-ball to 33.5 by 29 by 27.5 m.m., a rupture of the sclera in the staphyloma had occurred.

TREATMENT OF MYOPIA.—Seggel from an experience of 2070 myopic patients in boys' and girls' schools, extending over 22 years, during the last 6 years of which he carried out the full correction of myopia, finds that among the fully cor-

rected eyes the myopia in 43.4 per cent remained stationary, and among the uncorrected or partly corrected eyes only 22.3 per cent remained stationary. The beneficial influence of full correction is very striking between 10 and 14 years of age, the time when the tendency to increase is most pronounced; and under it myopia earlier ceases to be progressive. He also finds that the effect of full correction is the same in hereditary as in acquired myopia.

Liebreich insists on the importance of attention to muscular balance. He says: "First of all it is necessary to regulate the relation between convergence and accommodation." But his inclination to do this by prisms and to distrust correcting lenses, shows the influence of the older teaching. When a man can write on the treatment he advocated 41 years before, we may expect him to not appreciate fully the significance of the experience of the profession in the last decade.

In Claiborne's paper and in the discussion it brought out, the full correction of most cases of myopia was advocated. But there was evident a timidity about resorting to it, which seems strange when we consider the absence of injurious effects that can be ascribed to correcting lenses. A generation which has been educated under the theoretical prohibition of full correction in myopia, finds it difficult to shake off the influence of its early teaching, although experience has shown that such teaching was incorrect. Not all the treatment of myopia is comprised in wearing the full correction, and not all myopes should wear their full correction. But our present knowledge of the subject indicates emphatically that the full correction should be given unless the study of the individual case shows exceptional conditions which make it best to depart from the rule in that particular instance.

ASTIGMIA (ASTIGMATISM)

THE INTERFERENCE WITH VISION produced by astigmatia has been studied experimentally with the aid of the camera, by Sulzer. The camera is rendered astigmatic (astigmatic)

by placing before it a cylindrical lens. The effect of such a lens will be as much greater than the effect of the same number of diopters of astigmatism in the eye, as the dimensions of the camera are greater than those of the eye. Thus, with a camera 10 times the size of the eye, the effect of a 0.5 D. lens will be equal to that of 5 D. of astigmatism. A more convenient and practical study of the subject is made by holding in front of one's own eye a cylindrical lens, and noting the effect it produces on vision. The studies made with the camera, however, give results capable of exact record and comparison. Hence, they furnish a better basis for discussion.

Sulzer's photographs show that more lines of test letters are visible when one of the focal lines falls at the sensitive plate, than when the plate is placed between the focal lines, at the point where it will receive a circle of diffusion. It has been claimed that in astigmatic eyes it is common to use just sufficient accommodation to bring this circle of diffusion on the retina. Sulzer's experiments indicate that this cannot give the best vision for most objects.

The point his photographs bring out most strongly is the influence of the size of the pupil upon the disturbance of vision produced by astigmatism. This point may also be brought out by looking through apertures of different sizes with the cylinder held before one's eye. A very practical application of this fact is the dilatation of the pupil to secure greater accuracy in the results obtained with test lenses.

DIRECTION OF MERIDIANS.—Bennett and Clemesha have analyzed the records of 7665 astigmatic eyes, most of them tested under cycloplegics, with reference to the direction of their principal meridians. They classified their cases in four groups: vertical, those lying within 25 degrees of the vertical line on either side; horizontal, those lying within 20 degrees of the horizontal meridian; oblique, those lying intermediate between the two former regions; temporal oblique having the upper end of the meridian inclined from the median line, and nasal oblique having the upper end inclined toward the median line. The different percentages for the

different decades of life are shown in the accompanying table, the first column giving the decades, the second column the number of eyes tested, and the other columns the percentage of meridians in the various directions as above classified.

TABLE SHOWING DIRECTION OF MERIDIANS OF GREATEST CURVATURE.

Age.	Total Eyes.	Vertical.	Horizontal.	Temporal Oblique.	Nasal Oblique.
1-10	233	87.98	5.93	3.8	4.29
10-20	1329	77.8	10.23	4.74	7.22
20-30	2508	75.71	11.08	4.94	8.26
30-40	1808	71.34	13.27	5.47	9.90
40-50	1091	54.81	26.03	6.69	12.46
50-60	479	37.78	39.04	10.85	12.31
60-70	163	30.67	42.33	15.95	11.04
70	54	29.63	62.96	0.	7.40

The striking thing about this table is the decrease, with age, of the number of eyes having the meridian of greatest refraction approximately vertical, and the increase of the number of eyes having it approximately horizontal. That astigmatism may change in direction as well as in amount has of late years been generally recognized. But this table seems to indicate that a radical change of direction is the rule rather than the exception; and the change of direction is most common between the ages of 40 and 60.

Bennett and Clemesha express their results in diagrams, giving separate diagrams also for different varieties of astigmatism and for different degrees. But when allowance is made for variations due to the smaller number of cases, the different varieties and degrees of astigmatism do not show very different proportions of meridians in these four different directions.

Attention is called by Eaton to the method of finding the true direction for the cylinder axis when the best vision has been obtained through two cylinders before the eye with their axes oblique to one another. Such a combination of cylinders can always be replaced by a single sphero-cylindri-

cal lens. There are many cases of astigmatism that one cylinder will not wholly correct; but such cases are irregular, and can no more be corrected by two or several cylinders than by the one cylinder if that one have the proper strength and be placed with the axis in the proper direction.

CURE BY OPERATION.—The changes in astigmatism produced by corneal sections; especially for cataract extractions, are familiar to all. Fridenberg reports a case in which a wound produced by a broken spectacle glass, apparently not deep, extending horizontally across the cornea opposite the lower half of the pupil, caused the disappearance of an astigmatism which had previously required $+0.75$ D axis 90 degrees for its correction. The ophthalmometer showed a corresponding change in the corneal curvature.

It will probably be a long time before operation will be attempted for the relief of astigmatism of such a moderate degree; but the location and character of the wound that produced such an effect is a matter of interest. For very high degrees of astigmatism, however, under certain circumstances operation is now a justifiable surgical procedure.

There is a form of corneal degeneration characterized by opacity and alterations of the corneal curvature without ulceration or symptoms of inflammation, which gives rise to very high degrees of astigmatism; such degrees as otherwise are only seen resulting from conical cornea or trauma. Under the name "Marginal Dystrophy of the Cornea," a case of this affection was reported by F. Terrien to the Paris Society of Ophthalmology, December 5th, 1899. It was attended with astigmatism against the rule, of 11 D.; and treatment by six applications of the actual cautery to the corneal lesions at the upper margin of the cornea changed this to astigmatism with the rule, 1 D.; and improved vision from $1/50$ to $1/3$.

Clark reports a case of the kind treated by cauterization, with the result even more satisfactory. To start with, the left cornea had a radius of 10.4 m.m. in the vertical, and 6.3 m.m. in the horizontal meridian. The astigmatism was 22 D.; and vision was reduced to counting fingers at 4 meters. The

right eye had vision of 5/5 without a glass. The cornea presented a groove-like line of what appeared to be calcareous degeneration in the upper segment, 2 mm. in width and 3 mm. within the corneal margin. This line was first curetted and touched with carbolic acid, and 12 days later the galvano-cautery was applied throughout its whole extent. The other eye, which presented a smaller groove, was also cauterized. The cauterization was not repeated. At the end of 9 months the right eye still required no correcting lens; and the left took -7 . cy. axis 75° with $+2.5$ cy. axis 165° . The vision in each eye was 5/4.

The distortion of the cornea in this case closely resembled that following cataract extraction. In a few cases in which the astigmatism remains very high after lens extraction, it might be worth while to attempt to diminish it by cauterizing the corneal wound. In this connection it should be remembered that Breur claimed in the *Lancet*, 6-1-1901, to have benefited 15 cases of astigmatism by cauterizing a point at the end of the most hyperopic meridian. His paper claimed too much to commend it to the conservative surgeon; but the method is worth bearing in mind. In the present state of our knowledge, the galvano-cautery seems to be the safest means of altering the corneal curvature.

Astigmatism disappearing after tenotomy of the externus is reported by G. J. Bull. Before the operation the patient used -1.75 D. cyl. axis vertical, giving V.=6/5. Three days after the operation the same vision was obtained without glasses, and the ophthalmometer showed that the defect of corneal curvature had disappeared.

In 1874, H. D. Noyes reported to the American Ophthalmological Society a case in which astigmatism of 2.D. in one eye and 3.25 D. in the other was first found after repeated tenotomies for insufficiency of the interni. But in Noyes' case several years had elapsed, so that the appearance of the astigmatism may have been gradual and merely a coincidence. In Bull's case the implication of cause and effect is very strong. But although he seems to attach much importance

to it, he reports but the single case; and many surgeons have repeatedly measured the refraction before and after tenotomy, only to find little or no change produced by the operation.

ACCOMMODATION

MECHANISM OF ACCOMMODATION.—An important study of the changes that occur in the crystalline lens during accommodation has been made by Karl Grossmann. A man aged 26 had complete aniridia and small opacities at the anterior and posterior poles of the crystalline lens in each eye. Otherwise the media were clear and the eyes normal. The whole periphery of each lens could be seen. With correcting lens the patient had $1/6$ vision, and could see Jaeger 5 with difficulty. These eyes were studied with skiascopy and with the ophthalmometer during normal accommodation and relaxation, and under the influence of homatropin and eserine.

It was demonstrated by skiascopy that during accommodation, while the center of the lens became more refractive, the periphery became relatively less so; that there developed a negative aberration such as can be observed in the normal accommodation of many eyes with the pupil slightly dilated.

In the second place the reflection of three points of light, obtained from the anterior and posterior surfaces of the lens, showed that during accommodation both these surfaces became comparatively flattened toward the periphery. Both became comparatively conical in form.

The position of the anterior and posterior polar cataracts was carefully determined by focusing with a compound microscope. Without accommodation the thickness of the lens was 3.14 mm. Under eserine it increased to 4.44 mm. Without accommodation the anterior pole of the lens was 3 mm. behind the anterior surface of the cornea; with eserine it was 2.5 mm. During accommodation, therefore, while the anterior pole of the lens advanced, the posterior pole receded.

During accommodation with eserine the lens became mark-

edly tremulous, as it is stated, by Hess and Heine, to do, in normal eyes. During accommodation the ciliary processes, otherwise invisible, came clearly into view, and the diameter of the lens noticeably diminished.

It would seem, in so far as this case was concerned, Grossmann demonstrated that accommodation takes place with contraction of the ciliary muscle (rendering the processes more prominent); relaxation of the zonula (allowing the lens to become tremulous); and the development of lenticonus, both anterior and posterior.

The theory of Helmholtz is supported in so far as it supposes a relaxation of the zonula during accommodation. The observation of Tscherning of the peripheral flattening of the lens surfaces is confirmed. Helmholtz is shown to be wrong in assuming that during accommodation the lens became more nearly spherical, and Tscherning is wrong in thinking that the flattening of the lens depends on tension of the zonula.

The suggestion of Priestley Smith (*Ophthalmic Review*, November, 1898) that increased conicity of the lens surfaces might be brought about by relaxation of the zonula through an arrangement of the lens fibers causing resistance progressively greater toward the equator, seems to be what is needed to harmonize the supposedly conflicting observations upon which the opposing theories of accommodation have been built.

ASTIGMIC ACCOMMODATION.—That the lens is capable of unequal accommodation in different meridians has often been assumed; and has sometimes been supposed to have been demonstrated. Priestley Smith's hypothesis of greater resistance in certain parts of the lens, might be varied so as to assume greater resistance in certain directions. But we must not fail to distinguish between an attractive hypothesis and a proven fact. Brandes believes that he has demonstrated the possibility of astigmatic accommodation by the local application of homatropin and eserine. He experimented on 28 persons. He placed a small piece of the solid drug at the

end of a certain meridian of the cornea, surrounding it by cotton to prevent its diffusion. In this way he thought he obtained the physiologic action on a limited portion of the ciliary muscle, as the deformity of the pupil indicated a similarly localized action upon the iris. In this way he was able to get 1.D. less of accommodation in a certain meridian, with homatropin; and sometimes as much as 2 or 2.5 D. (though commonly not over 1.D.) greater accommodation in a certain meridian with eserine. These differences, however, quickly disappeared through general diffusion of the drug.

It may be admitted that Brandes' observations are entirely correct, and that partial paresis or partial spasm of the ciliary muscle can cause unequal changes in the lens curvatures in the different meridians. But it would be an unwarranted assumption to suppose from this that such unequal accommodation could be brought about through nervous impulses acting on the normal ciliary muscle. In other words, it remains entirely undemonstrated that partial or unequal accommodation is available to correct astigmatism; and the fact that the ciliary muscle consists of unstriated muscle cells, raises a strong presumption against any such differentiation in function of its different parts. Such unequal accommodation may occur; but before admitting its existence we should demand that it be demonstrated objectively, as it might by skiascopy. I have looked for it many times, and have sometimes thought I had discovered it; but more study of the case has always left uncertainty as to the correctness of such an observation. The character of most of the published evidence upon this point is well illustrated by one case reported by Pflueger. A girl of 12 had diphtheritic paralysis of accommodation. Her vision was improved by 0.25 D. cyl. But after recovery from the paralysis all cylinders were rejected. The ophthalmometer showed 1.25 D. of corneal astigmatism.

More suggestive is another case reported by Pflueger. A man who had suffered 5 or 6 weeks previously from influenza, presented himself with a myopia of 2.D. in the vertical

meridian, and 4.D. in the horizontal. This was measured by the shadow-test and the ophthalmoscope, and his vision of 1/10 was raised to 6/10 by concave correcting lenses. The ophthalmometer showed 0.75 D. of corneal astigmatism with the rule. After 2 days' use of a mydriatic, with aspirin and diaphoresis, the eye was found to be emmetropic; and one week later vision had risen to normal without any lens. Cases like this must be rare; but a few of them, carefully reported, will teach more than we yet know of astigmatic accommodation.

PARALYSIS OF ACCOMMODATION.—Helbron, among 300,000 patients treated in the Berlin University Eye Clinic, found 103 had paralysis of accommodation. Of these, 27 were noted as unilateral, and 57 as bilateral. He separates them according to causation, into three groups: (1) affections of the nervous system; (2) infectious diseases; and (3) intoxications. Of his cases, 31 (all bilateral) occurred after diphtheria. One of these was complicated by paralysis of the sphincter of the iris, and 3 by paresis of the abducens. Usually the recovery was complete; but it was not so in one case at the end of 9 months; and in another after 3 years. In syphilis, both eyes were affected in 7 cases, and only one eye in 12 cases. The pupil was affected in 7 cases, and other ocular palsies were present in six. A case of paralysis of accommodation is reported by Mandonnet as occurring 5 or 6 weeks after an attack of mumps. It closely resembled paralysis following diphtheria, being bilateral and without much dilatation of the pupils. The patient had not been seen during the original attack. Inherited syphilis does not cause paralysis of accommodation so frequently as the acquired disease; but a case is reported by Cruchadeau.

Suker points out that in young people paresis of accommodation can be approximately measured; but it cannot be recognized in later life. It is not likely to attract the patient's attention unless it is greater than the latent portion of the accommodation. In the lower degrees its symptoms are those of asthenopia; and if but one eye is affected, the annoyance caused is not very marked.

SPASM OF THE CILIARY MUSCLE.—Wright makes a distinction between what he calls “cramp” of the ciliary muscle, which may be produced by over-work, and hypertrophy of the muscle, which may prevent its complete relaxation, as in hyperopia thus rendered latent. To these we might add spasm due to organic disease and that caused by poisoning, as by myotics or auto-intoxication. It would be well to make some such distinction between our different cases of temporary increase of dynamic refraction. A careful study of cases with this in view will certainly improve our knowledge of them. Possibly two or more causes act in conjunction to produce such extreme cases as that referred to in *American Medicine*, 1-3-1903, in which an apparent myopia of 9.D. was proven to be due to ciliary spasm.

Ocular Movements

It is still rather common to refer to disorders of the ocular movements as disorders of the ocular muscles. It is true that the muscles have an essential part in the movements of the eyes. But so have the tendons, the nerve trunks and the nerve centers. In typical comitant strabismus the muscles concerned present no abnormality as a rule; and when they are altered, the alteration is a consequence rather than a cause of the squint. In paralytic squint the muscles may be degenerated, but only as a consequence of previous lesions of the nerve trunks or nuclei. This matter is of importance because the common errors about squint depend on regarding it as a disorder of the ocular muscles, which essentially or primarily it is not.

Even while speaking of “neuricity,” the impulse sent along the nerve, as though it were simply an attribute of the muscle, Savage, who wrote of the ocular movements under the title “Ophthalmic Myology,” recognizes that “neuricity” is the essential thing to be eliminated in all treatment of heterophoria, non-surgical or surgical. The articles by

Worth and others during the past year tend to emphasize the fact that the muscle is nothing but an instrument to execute the commands of the nervous system; that its strength and dimensions depend upon nerve impulses; and that when they permanently cease, it ceases to exist, as a muscle. Let us have language that will accurately express what we now know. Let us imply the broader view of disorders of ocular movements.

NOMENCLATURE.—The recognition and differentiation of various conditions and disorders of ocular movements has been more recent and more rapid than the recognition and differentiation of various errors of refraction; and there is a correspondingly greater need for new terms and revised definitions. One difficulty about the adoption of such terms is that a recognition of the need has often prompted the proposal of two or more words to express the same idea. While in some instances different proposers have employed the same word for ideas which differ sufficiently to require different terms. Of course each new word is supported by a classical derivation, that looks good enough until it is challenged by some one who believes that he has a better word to suggest.

In this state of affairs one may feel constrained to adopt the new words cautiously; and until the debate as to derivation has been heard or a preponderance of usage seems clear, to adhere to the older, inexact and roundabout expressions. The terms given below seem, however, to meet real needs of the language, and to be well enough supported to justify their adoption. They are among those advocated by Duane. Others suggested by him, and by other writers during the year, cannot be regarded as having proved their necessity and fitness:

Comitant instead of *concomitant*.

Abduction, the power to turn the eye from the median plane.

Adduction, the power to turn the eye toward the median plane.

Elevation, the power of turning the eye upward.

Depression, the power of turning it downward.

Divergence, the power of departing from parallelism of the visual axes by abduction.

Convergence, the power of departing from parallelism by adduction.

When these latter are brought out by the use of prisms, they may be called *prism-divergence* and *prism-convergence*; although these expressions might each be replaced by a single comparatively brief word.

The various movements of the eyes in which the two move together and preserve parallelism may be called *versions*. *Dextro-version*, to the right; *Levo-version*, to the left; *Sursum-version*, upward; *Deorsum-version*, downward.

The departures of the vertical meridians of the two eyes from the position of parallelism, may be called *torsions*; *intorsion*, when the upper ends of the meridians approach each other; *extorsion*, when the upper ends of the meridians depart from each other.

We cannot give up general terms like "squint" or "strabismus"; but in speaking of a particular variety, it is well to have a single appropriate word, thus, *esotropia*, for convergent squint; *exotropia*, for divergent; and *hypertropia*, for vertical strabismus, calling it right or left according to the eye that deviates upward.

PHYSIOLOGY OF MOVEMENTS.—By means of the continuous photograph (kinetogram) Dodge has studied the character of the usual movements of the eyes. He distinguishes the following types:

Fixation Movements. These are reactions to eccentric retinal stimulation. Some image on the periphery attracting attention, the eye is turned to fix upon it. Such movements are not influenced by voluntary effort. They are rapid, but during their continuance vision is interrupted.

Pursuit Movements. These occur when the eye endeavors to continue its fixation upon a moving object. The line

of regard appears to lag behind the object, and to overtake it from time to time by short movements of the fixation type. But pursuit movements are attended with clear vision. They also occur when the object is stationary and the eye moving; as in viewing things from a car window.

Co-ordinate Compensatory Movements occur when the eyes are kept fixed on an unmoved object and the head is rotated. They resemble pursuit movements, but usually keep the line of regard continuously on the object.

Reactive Compensatory Movements occur when the eyes are closed and the person quickly rotated, first in one direction and then in another, as in a revolving chair. These are studied by the sense of touch, the eye being felt to move in the direction opposite to that of the movement of the head.

Movements of Convergence and Divergence, to fix objects placed at different distances, differ from fixation movements in being slower, and in permitting clear perception during the period of movement.

VOLUNTARY DIS-ASSOCIATION OF THE EYE MOVEMENTS.—Some light is thrown on the physiology of the ocular movements by those rare cases, in which the movements of the two eyes can be voluntarily dis-associated. A striking case of the kind is reported by Weinhold. A young man with normal vision in each eye separately, and normal binocular and stereoscopic vision, had sometime during boyhood acquired the power of dis-associating the eyes, and turning the left eye strongly upward. He was thus able to display a deviation of 10° or 15° , although ordinarily he showed but 1° of heterophoria. This deviation was attended with diplopia, the double images being equally clear, and either one permitting him to read the smallest type.

The dis-association that occurs from disease is much more common, and if carefully studied is equally instructive. Wernicke reports a case of tubercle of the pons, causing complete loss of the conjugate lateral movements of both eyes, while the power of convergence was retained. A tumor was found in the pons exactly in the median line, the 6th nucleus having been destroyed.

Loss of Convergence and Divergence, with a retention of good lateral version movements, is reported by Duane, in a case that had been subjected to many tenotomies for paresis of one superior rectus. The patient showed no evidence of organic nervous disease. The case illustrates the impossibility of securing binocular vision by any operation or series of operations, without the assistance of the nervous system to modify the action of the ocular muscles by appropriate impulses. When operation had given the patient single vision at the proper distance for near work, she still had homonymous diplopia beyond 17 inches, and crossed diplopia for objects closer than 15 inches. Yet the excursion of either eye inward or outward, in performing associated parallel movements, was normal.

PARALYTIC SQUINT

UNUSUAL PALSIES.—The majority of ocular palsies cause such disturbance of vision and such evident deviation of the eye-ball that they naturally come to the ophthalmic surgeon for relief. Even though due to general disease and having the highest symptomatic value for the neurologist, in the more complex conditions only one who is skilled in unravelling the problems of diplopia will be able to determine the particular nerve trunk or nucleus involved. Thus, Sidler-Huguenin reports a case of binocular *paralysis of convergence*, with facial paresis on one side, and micropsia, macropsia and dyschromatopsia. Yvert narrates one in which the superior oblique, the elevator of the lid, the ciliary muscle and iris sphincter were involved.

In learning to analyze complicated cases one must know the function of each muscle and the anatomy of the parts of the nervous system that control it. Then he must take the concrete case and work it out. This may be done with either a case well reported in detail, studying to full appreciation every symptom mentioned; or the case as it is presented by the individual patient. The reports of such cases form an extremely valuable part of ophthalmic literature.

But in the main they cannot be abstracted. The best that can be done with them in this connection is to pick out here and there a striking feature, which may have application in various different directions.

A paralysis of the 6th and 7th right cranial nerves, with left hemiplegia at the age of 8 years, reported by Andrade, was due to congenital syphilis. Cruchadeau reports a bilateral internal ophthalmoplegia in a boy of 10, from the same cause. Andrade's case is closely allied to the oculomotor paralysis with hemiplegia of the opposite side, known as *Weber's syndrome*, which indicates a lesion of the inferior part of the cerebral peduncle or the neighboring portion of the pons. Teillais reports a case of diphtheritic paralysis in which the oculomotor paralysis was complete on the right side and partial on the left, and was associated with left hemiplegia.

Paralysis of Elevation of both eyes is reported by Snell. It occurred suddenly; was at first attended with severe pain in the forehead, diplopia and giddiness. In all directions, except upward, the movements of the eyes were normal. Vision was 6/6 and there was no disturbance of the pupils. Recovery of the elevators of both eyes was complete within two months.

THE FALSE PROJECTION which attends paralytic strabismus becomes an important obstacle to the use of the deviating eye. It also gives valuable suggestions as to the compensatory actions, by which an attempt is made to replace through other muscles the power of rotating the eye, that has been lost. It is worthy of more investigation than has usually been given to it. For this purpose the apparatus used by Landolt, shown in Fig. 4, is valuable. It is simple, and its essential features can be readily reproduced.

A blackboard (A) placed in an upright position, has in the center a vertical, white line V O. Another board (B), is fastened to it by means of hinges. The free border of the latter D D, has a hollow which fits the neck of the patient. During the examination the board, B., is placed hor-

izontally. The neck of the patient being fitted in the curve, his eyes are seventy centimeters from the blackboard and he sees the white line immediately in front of him above the horizontal board, which entirely hides from him the lower part of the blackboard as well as his own arms.

Below the horizontal board is a scale, the zero point of which corresponds to the vertical line. To the right and left of this are indicated the tangents of the angles for a radius equal to the distance which separates the patient's eyes from the blackboard. One eye of the person to be examined

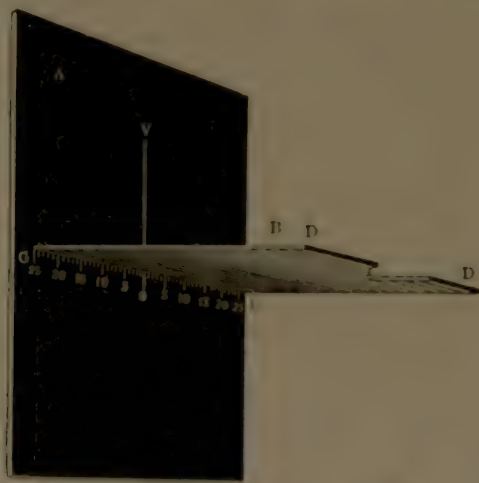


Fig. 4. Landolt's Test of Projection.

is covered and he is asked to touch quickly the spot on the scale where he supposes the prolongation of the vertical line to be. But, in order that the results may be depended upon, it must be done very rapidly; and done alternating with first one and then the other hand, and the patient should not be told whether he touches correctly or not.

RECURRING OCULO-MOTOR PARALYSIS is always of interest. Sym reports a case in which the first attack occurred in a woman at the age of 31, in the last month of her fourth

pregnancy. In her fifth pregnancy it came on 6 weeks before confinement; but ended in rapid and complete recovery when the baby was about a week old. The third attack began 9 or 10 weeks before the close of the 6th pregnancy, and only partial recovery was obtained two years afterwards. There was some complaint of headache, but not of the severe hemi-crania that commonly attends such palsies.

Schilling, who reports a case commencing at 8 years and accompanied by the usual migraine, suggests as the cause, congenital weakness of the nerve involved; so that it is easily injured by accumulated metabolic toxins, and becomes progressively more liable to their influence. This explanation would suit Sym's case if we assume that an especial toxin, intensified during pregnancy, was the efficient cause. The supposed congenital susceptibility to such injurious influences would account for the usual appearance of the trouble in childhood.

Petella reports a case in which paralysis of the 3rd, 4th and 6th nerves recurred 3 times in a month and a half; but the patient, a woman aged 38, had subsequently remained free from the paralysis for 3 years.

PARALYTIC SQUINT DUE TO TRAUMATISM may arise from a blow upon any portion of the head, by compression of the head, causing fracture of the base, or by direct injury in the orbit. Lauder reports three cases of paralysis of the *external recti* muscles, in two of which the injury seems to have been confined to the 6th nerve, while in the third both the 7th and 8th nerves were also involved. One had been struck on the head while attempting to stop a fight; another had been on the bumpers of a freight car which was wrecked; the third was struck on the top of the head by an ore or coal bucket. Two cases of isolated paralysis of the 6th pair occurring in children, are reported by La Roux. The head of one had been compressed between two boats, and of the other between an empty barrel and the pavement. In one of Lauder's cases and one of La Roux's, recovery was complete. In La Roux's other case recovery was complete upon one side, while upon the other the paralysis was permanent.

Dunn reports a case of isolated paralysis of the *superior oblique* from a fall on an icy pavement. It ended in complete recovery.

Desgauttes and Muller report two cases of isolated complete paralysis of the *oculo-motor* nerve. One was caused by a fall on a stairway, the other by a fall from a carriage. Both terminated in nearly complete recovery. Palsy of the inferior rectus from a blow on the head is reported by de Laperousse. He accounts for it by the supposition of hemorrhage within the muscle sheath. This case ended in practically complete recovery.

Goldzieher gives two cases of traumatic palsies produced by *stabs in the orbit*, one with a pen or compasses; the other by a knife. In both the injury caused blindness, as well as paralysis of the extraocular muscles.

Kempner describes an injury by a thrust from a stick as thick as the finger, received close to the root of the nose. The elevator of the lid, the superior rectus and the superior oblique were injured. Quintela reports two cases of paralysis of the superior oblique caused by the operation of opening the frontal sinus by Lac's method.

COMITANT SQUINT

THE FUSION FACULTY.—From recent studies of this subject the fact that a real cure is possible only at a very early age, stands out more and more clearly. The normal development of the fusion sense has been studied by Worth. He finds that from earliest infancy the light reflex and fixation reflex are present. When two or three weeks old most infants will fix the ophthalmoscope mirror steadily for several seconds with either eye; but will not converge both visual axes accurately to it. At 5 or 6 weeks the child will usually be found to fix the mirror with both eyes. During the earlier months of life the movements of the eyes are uncertain, and deviations are liable to occur in the horizontal

plane from very slight causes. From the first the eyes are pretty well co-ordinated as to the vertical movements. By 5 or 6 months there is evidence of a desire for binocular fusion. When a prism is slipped before one eye, it may be seen to move in such a way as to avoid diplopia. Between 12 and 18 months some infants will show their dislike of the diplopia, when a vertical prism is slipped before the eye, by "screwing up the eyes and twisting the head."

Worth believes that in practically all cases the faculty of binocular fusion is developed before the age of 6 years, or it is not developed at all; and, in a large proportion of children it is developed at a very much earlier period. Defect of the fusion faculty he regards as the essential characteristic of comitant squint. In convergent squint (esotropia) the only other essential condition is the excessive convergence of the visual axes. But we commonly find: Suppression of vision in the unused eye; in rare instances congenital amblyopia; very often acquired amblyopia in the deviating eye; and usually a refractive error.

As bearing on the innocence of the ocular muscles in the matter of squint, Worth notes that among 1523 cases of esotropia, the abduction of each eye separately was perfect in 81 per cent. The cases in which abduction was deficient were almost invariably of long standing. Squint may cause abnormality of the ocular muscles; but abnormality of the muscles practically never causes squint. We must see through the obvious symptom of a contracted muscle to its cause, excessive innervation, uncontrolled by binocular fusion.

The importance of binocular fusion is the keynote of Worth's work. As might be supposed from the period at which binocular fusion should develop, the lack of it is revealed by the beginning of convergent squint before 6 years of age, in more than 92 per cent of the cases. It begins before 4 years in about 75 per cent, and before 3 years in the majority of cases. The most important practical deductions from these facts will be discussed under "Treatment."

Worth emphasizes the importance of the fusion sense by statistics of 157 younger brothers and sisters of "squinters," that he has tested with his amblyoscope. He found the fusion faculty well developed in 106; of these not one subsequently squinted. Of 37 noted as doubtful, 6 had since squinted. Of 14 children in whom the fusion faculty was very deficient, 8 subsequently developed constant squint.

In his appreciation of the fusion sense Worth does not stand alone. But he has illustrated its importance by some new facts, and has done more than others to turn it to practical account in treatment.

AMBLYOPIA OF SQUINT.—Worth takes the position that it is generally acquired. That before the squint occurs the deviating eye has good vision, or at least capacity for its development. While admitting the occurrence of congenital amblyopia, he finds it unusual and comparatively unimportant. He gives statistics which tend to show that the amblyopia is worse the longer the squint has continued. He also reports cases where the squint has been permanently transferred from one eye to the other, and presumably the visual ability of the two eyes reversed, by use of the originally deviating eye. These cases are very suggestive of the acquirement of amblyopia, but are really not so conclusive as cases that have been previously reported by others.

The acuteness of vision in very young children, Worth tests with a series of 5 ivory balls, varying in diameter from $\frac{1}{2}$ to $1\frac{1}{2}$ inches. The child is first allowed to handle them, with both eyes open. Then one eye is covered by a pad, or cotton placed behind its glass, and the child is asked to pick up the balls as, one by one, beginning with the largest, they are thrown on the floor to a distance of 6 or 7 yards. By the way the child runs for it, one may judge whether he sees the ball from the start, or is only looking for it.

AMETROPIA AND SQUINT.—The share which ametropia has in the causation of squint is spoken of rather slightly by Worth, altho the first step in the treatment of all his cases is the correction of the ametropia. Its influence is also

invoked to bring about a transfer of the deviation in the interests of vision in the poorer eye, by the use of atropin in the fixing eye.

He has been led into error by poorly chosen control statistics. He even found a series of cases which he relies on for comparison in which the proportion of eyes having less than 2 D. of hyperopia was lower among non-squinters than among squinters. Evidently his statistics for non-squinting eyes were drawn from a clinic where only comparatively high degrees of hyperopia appeared or were measured. In 1889 I published some statistics of the static refraction of the eye, in the Transactions of the American Ophthalmological Society. They included 1616 hyperopic eyes, probably representing approximately the frequency of the different degrees of hyperopia in the community. Let us compare these with Worth's statistics of the hyperopia in his 1384 cases of monolateral squint. (See page 43 of his book.)

	In the Community. (Jackson.)	Having Con. Squint. (Worth)
Hyperopia of not over 2 D.	80 per cent	10 per cent
“ “ 2 to 4 D.	16 “ “	37 “ “
“ “ 4 to 6 D.	3 “ “	36 “ “
“ “ not over 6 D.	1 “ “	9 “ “

Of my cases 851 had not over 1 D. of hyperopia, and 765 had over 1 D. of hyperopia. A clear majority having less than 1 D. of hyperopia seems to furnish 6 per cent of the cases of convergent squint. A minority of the community having more than 1 D. of hyperopia furnishes 94 per cent of convergent squint. Or, taking another phase of it, 4 per cent of the community who have over 4 diopters of hyperopia furnish 45 per cent of the convergent squints.

The actual facts are doubtless more striking than this. My statistics probably show an unduly high proportion of high degrees of hyperopia. Ellis, among 867 hyperopic eyes, found 603 had not over 1 D. of hyperopia. (Trans. Section on Ophthalmology, Amer. Med. Assn., 1895.) Then, too, my statistics are based on the average of the most and least

hyperopic meridians; while Worth's are based alone on the least hyperopic meridian of the fixing (usually the better) eye. The fallacy of a false standard of comparison needs only to be pointed out. Who will seriously claim that the average degree of hyperopia in non-squinting hyperopic eyes in the community at large is over 4 D., as the average was in the fixing eye of Worth's cases of monolateral convergent squint? If there is any one thing that Worth's statistics do establish it is the connection of the higher degrees (above 2 D.) of hyperopia with convergent squint.

TO MEASURE THE DEGREE OF SQUINT Worth uses the corneal reflex. He employs a "deviometer" which consists essentially of a horizontal arm that can be swung either way, carrying a slide with a white spot towards which the child is induced to look. An electric lamp opposite the pivot of the arm can be flashed on or off, to give the corneal reflex. The surgeon watches the cornea from just above the electric light; and a tangent scale on the back of the arm indicates the amount of deviation.

TREATMENT OF CONVERGENT STRABISMUS.—From years of widespread interest in disorders of the ocular movements, much writing about them, much experimenting with operations, and more advocacy than use of orthoptic training, there begins to emerge a definite, rational line of treatment that can be applied with certainty of cure in curable cases, and with certainty of improvement in cases not capable of complete cure. This treatment has been most definitely formulated and extensively used by Worth. But Hartridge, Black, Hale and others who have written on the subject within the past year, and the larger number of surgeons who participated in the discussions which their papers opened, substantially agree to the essential features of Worth's plan of treatment.

For a complete cure the power of binocular fusion must be developed or capable of development. The treatment must be begun at an age when the fusion faculty is still developing. This is always before 6 years, generally earlier than 4; unless

binocular fusion had been developed at an earlier age, and the squint has commenced subsequently.

The first thing to be attained is the *correction of the ametropia* present. This must be measured under atropine, by skiascopy. If at the first attempt the child's fixation is so poor that accuracy in such measurement is impossible, the best correction practicable must be made, and this revised whenever further improvement is possible.

Next, *the deviating eye must be brought into use*. To effect this it may be necessary to cover the fixing eye continuously with a pad, so secured that the child cannot remove it. Often it is only necessary to continue the use of atropine in the fixing eye while allowing the deviating eye to recover from it. By many weeks or months dependence on it, the worse eye may be brought back to its power of central fixation, if this had been lost, and its visual ability developed.

Training of the fusion faculty is then to be undertaken. In commencing this the two eyes must be brought as nearly as possible to visual equality by the better illumination of the image presented to the more defective eye. The first step is to secure simultaneous vision with the two eyes. For this purpose dissimilar objects are presented to them; as a bird before one, a cage before the other; or a circle to one, a cross to the other.

When these can readily be recognized simultaneously, and with some variations of relative illumination, actual fusion of images is to be attempted. For this purpose we employ figures that have most parts common to both; but each of which is defective in some respect, the one differing from the other. When the attempt at fusion is successful the complete figure, including all the parts represented in both the half images, will be seen. The next step is to keep this figure complete and single when the inclination of the visual axes is varied, by changing the adjustment of the instrument. When binocular fusion can be maintained in spite of a variation of several degrees in the relative direction of the half images, the final step is taken by means of pictures which combined together give the effect of relief or depth.

In this course of training, Worth and Black depend on the amblyoscope. The heteroscope, or fusion tubes of Priestley Smith, I have found serviceable up to the last stage in the process, when the ordinary stereoscope and stereoscopic slides may be employed. The training must be closely supervised or carried out entirely by the surgeon. Tact, time and patience are required for it. But only the most intelligent application of the methods of fusion training will give the desired results. The lessons may be repeated one, two or three times a week.

All this development of the faculty of binocular fusion may go on without any change in the degree of squint. The wearing of correcting lenses, with the use of the defective eye, may have lessened the deviation, or removed it altogether for a portion of the time, before fusion training commenced. In such a case fusion training will probably lead to the habitual use of binocular vision, and complete the cure.

Operation. If, however, the power of fusion has been developed to the perception of relief; and the deviation still remains constant, the time has arrived for operation. Under these circumstances it may be done with great confidence of securing a complete and permanent cure. After reaching this stage, the sooner the operation is done the better. If, however, persistent training fails to develop the power of binocular fusion, up to the point where fusion can be preserved in spite of slight changes in the direction of the visual axes, operation had better be deferred until it can be done under cocaine with the intelligent co-operation of the patient and until the development of the ocular movements has proceeded so far that the relations between the two eyes are not likely to undergo much further alteration.

As to when operation should be done in these cases, there is yet great uncertainty. But apparently it is safer to wait until after the period of most rapid growth and development; say, to the 15th or 18th years, altho incomplete correction of very great deformity may be undertaken earlier.

RESULTS OF TREATMENT.—The constant use of correcting lenses, supplemented by atropine in the better eye, or by similar measures for forcing the worse eye into use, cures about one-third of all cases of comitant convergent squint. Statistics as to the further gain effected by fusion-training are still meagre. But Worth reports that of 78 cases apparently suitable for fusion training, he failed to develop the fusion faculty in 12; and in 7 the result was only moderate. In 59 a good amplitude of fusion was developed. In two of these the operation which was necessary was refused by the parents. Four cases were lost sight of. But 53 were perfectly and permanently cured. It would thus appear that fusion training, by methods already in use, can double the percentage of cures over those obtained by the use of correcting lenses without such training. It must, however, be observed that the statistics regarding correcting lenses are based upon their use at an average age greater than that of cases suitable for fusion training. Hence, the gain by the latter may not really be so great when we come to compare its results with those obtained by using correcting lenses at an earlier age. On the other hand the cures obtained by fusion training may be more complete and permanent. It should be noted that cures of this kind are totally different from those referred to in statistics of the results of squint operations, where among hundreds reported cured, perhaps not one has been given binocular vision; and many are sure subsequently to show recurrence of the former deviation, or deviation in the opposite direction.

DIVERGENT STRABISMUS.—Additional light upon the causation of squint and the importance of the fusion faculty, is derived from a study of comitant divergent strabismus. Worth recognizes two distinct varieties, which he calls myopic and neuropathic. "Myopic squint" usually arises at 10 years of age or later. The power of binocular fusion has been previously developed; but myopia has increased to such an extent that the blurring of all but the nearest objects so lessens the annoyance from diplopia as to permit deviation.

"Neuropathic squint" dates from infancy, and is marked by absence or great feebleness of the fusion sense. Such squints are quite variable, and there is lack of the normal co-ordination of accommodation and convergence.

Little can be done for the correction of neuropathic squint. Myopic divergent squint can usually be cured by correcting lenses, and operation when necessary. But this important exception must be borne in mind. Extreme myopia, by elongation of the eye-ball, so limits all its movements, that a normal position and excursion are quite impossible; or, if restored temporarily by operation, will very quickly be lost.

OPERATIONS ON THE OCULAR MUSCLES

As to what operation should be resorted to, it may be noticed that advancement continues to grow in favor as compared with tenotomy. This is partly because advancement has never been so recklessly done as tenotomy, and therefore has never yielded so many bad results. But it is partly due to the real superiority of the operation, for many or most cases.

TENOTOMY.—Still tenotomy is not without friends. Marple advocates for divergent strabismus, Gruening's operation of *double tenotomy* of the externi, with adduction of the eyes for 24 hours by a suture introduced at the outer side of each cornea and tied over the nose. For a divergence of 2 mm. the tenotomy may be made at the insertion of the tendon. For a greater divergence the tendon should be divided a corresponding distance behind the insertion, and the stump excised. This operation is suited only for cases of constant primary squint, with good motility of the eyes.

A form of *partial tenotomy* has been proposed by Verhoeff. Each edge of the tendon is divided at its insertion; and again about 5 mm. from the insertion. Half way between these positions the central fibres are divided. Such partial division, Verhoeff holds, will be followed by a lengthening of the tendon. He calls it a "gradual plastic tenotomy."

ADVANCEMENT.—Savage suggests what he regards as the ideal advancement operation, to effect a folding of the tendon without cutting it. After exposing the tendon and raising it on a large hook, a suture with a needle on each end is passed through it, so that the thread includes 3 to 5 mm. of the center of the tendon. This stitch is placed as far back from the insertion as it is desired to make the fold. Then each needle is passed through the sclera; one above, the other below the plane of muscle action, and as far in front of the insertion as the loop of tendon is to be drawn. The needles are then passed out through the conjunctiva; and the suture tied over a suture plate, after the loop of tendon has been drawn sufficiently forward.

Jocqs and de Wecker both profess their satisfaction with advancement operations, and discuss chiefly questions of priority regarding advancement of the tendon with the capsule. Landolt makes a very strong argument in favor of advancement with resection of the tendon for paralytic strabismus and supports it with cases illustrative of its effect in various forms of ocular pareses.

Trousseau, under the name "*capsular ligature*," has described a very simple, but he claims effective form of advancement. Without opening the conjunctiva, the tendon is grasped through the conjunctiva and raised from the eyeball with forceps. A half-curved needle is then introduced near the sclero-corneal junction, and through the insertion of the tendon. The needle passes beneath the ocular surface of the tendon a sufficient distance and the point is then brought out through the tendon and conjunctiva. The suture is then drawn upon sufficiently and tied. He describes the operation as done on the externus in connection with tenotomy of the internus. But like other forms of advancement it can be done alone. The resulting roll of tissue is said in the end to disappear, leaving scarcely a trace.

In doing advancement Woodward finds that a thorough *stretching of the opposing muscle* lessens the liability of the stitches to cut out prematurely; and that it will sometimes take the place of a tenotomy.

Truly comitant *vertical squint* is extremely rare. For a case that might be regarded as of that character, Froehlich did advancement of the right superior rectus. The immediate effect was an over-correction which required an 18° prism to give single vision. But this gradually diminished, until in about 3 months the association of the two eyes was perfect.

The majority of cases of vertical deviation approaching comitant squint have their origin in paralysis of the superior oblique. The function of this muscle becomes partly restored; and the actions of the other muscles readjusted so that they assist it. Still, certain movements of the affected eye remain difficult and imperfect, so that the head may be habitually carried in an inclined position, or the use of the eyes attended with vertigo or headache.

LATERAL DISPLACEMENT OF INSERTION.—Attempts have been made to remedy this by tenotomy of the superior rectus of the affected eye. This has sometimes been of marked benefit; but often it fails to render the patient more comfortable. Weakness of the superior oblique means deficiency of the power of intorsion. In this movement its ally is the superior rectus; and tenotomy, weakening the superior rectus, increased the torsion difficulty. I have reported two cases in which after tenotomy, the tendon of the superior rectus was given a new insertion farther back, but also more to the temporal side than its normal position. This made in effect a tenotomy, in so far as the upward rotation of the eye-ball was concerned, and an advancement for purposes of intorsion. Both patients were permanently relieved.

The operation is done as follows: The conjunctiva is seized over the insertion of the superior rectus tendon, and an incision made as shown by the solid line in fig 1, the broken line indicating the tendon insertion (left eye). This incision begins about 8 mm. back from the cornea, over the nasal third of the tendon, and extends 3 or 4 mm. beyond the temporal margin of the tendon, its temporal end being farther back from the cornea. Through this incision the tendon is

raised and isolated on the strabismus hook. A small half-curved needle, threaded with fine silk, is then entered through the tendon (see fig. 5) at the point A.

The needle and suture are carried beneath the tendon, emerging at its temporal margin. At the point B, previously fixed upon, the needle is made to enter the sclera, deep enough to give a firm hold but not to perforate the sclera. It is carried about 3 mm. in the firm scleral tissue, and made to emerge at the point C. After this the needle is made to

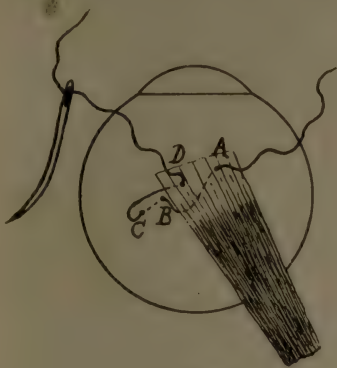


Fig. 5

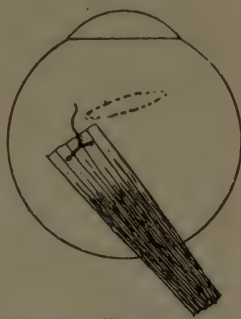


Fig. 6

Operation for Lateral Displacement of the Insertion of the Superior Rectus.

pass beneath the temporal margin of the tendon and caused to pierce it and emerge at the point D. Fig. 5 represents the suture so placed. Now the free ends of the suture and the loops A B and C D, which are left loose, are drawn out of the way. The tendon is divided close to its insertion and the suture is tightened and tied, bringing the central portion of the tendon A D in close contact with the sclera at B C. This gives the relation shown in fig. 6. The broken line indicates the original position of the tendon insertion.

Between A and D about the middle third of the tendon (3 or 4 mm.) should be included; the distance from B to C should be slightly less. In dividing the suture it is well to leave one end long enough to extend through the conjunctival incision as a guide when the suture is to be removed.

The placing of the suture before dividing the tendon is a little troublesome, but it is necessary in order to make an accurate adjustment.

To proportion the displacement of the insertion to the needs of the particular case is important. Assuming the radius of the eye-ball to be 12 mm., each mm. measured on



Fig. 7.—Evans' Case II. Attempted conjugate movement to the right. Left eye recedes as it turns inward.

its surface represents, approximately, 5 degrees of deviation, or the equivalent of a 10 degree prism. Assuming that increased or diminished muscular tension is distributed equally between opposing muscles, the displacement of the insertion should be made to represent double the number of degrees of the deviation to be corrected. Thus, to correct an extorsion of 5 degrees (10 centrads) the insertion of the muscle should be carried outward 2 mm. To correct an upward deviation of 10 degrees (20 centrads, a 20 degree prism) the insertion of the muscle should be carried back 4 mm.

Operative interference with the extra ocular muscles has heretofore been confined to setting the insertion of the muscle forward (advancement), or backward (tenotomy). In future the alteration of the action of a muscle by the lateral displacement of its insertion may prove to be of equal importance.



Fig. 8.—Attempted conjugate movement to the left. Left eye advances and fails to turn outward.

CONGENITAL DEFECTS OF MOVEMENT

DEFECT OF ABDUCTION WITH RETRACTION MOVEMENTS.
—Two new cases of this condition are reported by Evans, who gives in tabular form the principal points regarding previously reported cases, making 27, to which must be added 4 since reported, and which are referred to below.

In Evans' first case the right eye was normal and its movements perfect in all directions. The left eye in the primary position was slightly adducted and enophthalmic, and the

palpebral fissure narrower than the right. On looking to the right the adduction was less than that of the sound eye, the globe was still farther retracted and rotated downwards. On looking to the left this eye moved only to the middle line. But it became as prominent as the right eye, and its palpebral fissure as widely opened. Traction with conjunctival forceps produced normal rotation inward, but failed to rotate the eye outward beyond the median line. Evans' second case is illustrated in Figs. 7 and 8.

In his first case Evans operated on the left eye. He found the externus tendon inserted 10 mm. back from the cornea; and the muscle represented largely by a fibrous, although not absolutely inelastic tissue. Faradic stimulation caused no contraction in it. Microscopic examination of a small piece removed showed bundles of muscle fibres with very imperfect striation, and which did not stain well. At this operation the tendon was split and lengthened. It produced a convergent strabismus, for which the tendon of the internus was cut ten days later. This tendon also was inserted 10 mm. back from the corneal margin, and appeared more bulky and fibrous than normal. A few weeks later the condition was practically the same as before the operations.

Between the two theories suggested by Tuerk; the faulty insertion theory, which supposes the internus to be attached to the globe abnormally far back; and the fixation theory, which assumes that the externus is replaced by unyielding connective tissue, Evans does not undertake to decide. He urges that every case should be carefully studied before proceeding to treat it in accordance with either theory.

Evans' case, given above, is quite a typical one; Spuler's case closely resembles it. But the lids were opened more widely than those of the sound eye; and there seemed to be an actual protrusion, on attempting to look toward the affected side. Koeber reports 3 cases which were characterized by retraction movements, and apparently clearly belong to this class. Two of them which are fairly typical he seems to think may not have been congenital; and he suggests pos-

sible lesions of the central nervous system as a cause. His third patient had a shrunken globe and the retraction movements are ascribed to its abnormal cicatricial fixation. Of the 31 cases that have thus far been reported none have been cured. Nor have repeated operations in any case effected more than a very moderate cosmetic improvement; while in some the condition probably has been made worse by interference.

OTHER DEFECTS.—Barck reports 2 cases of congenital *oculo-motor paralysis*. In one case all the movements of the globe effected through the oculo-motor nerve were defective, and there was ptosis. In the other case there was no ptosis, but the external recti were also involved. In both cases the pupillary movements and accommodation were unaffected.

Congenital *absence of both inferior recti* muscles is reported by Stieren. The patient, a boy aged 6, was unable to turn the eyes below the horizontal plane. Objects below that plane were looked at by flexion of the head, not in a single movement, but by a series of jerky nods, until his line of vision was sufficiently depressed to include the object sought. Vision appeared to be good and the ophthalmoscope showed no abnormality. The eyes could be drawn down with forceps. An incision of the conjunctiva of one eye, and careful search for the inferior rectus, revealed its entire absence.

NYSTAGMUS

Hereditary Nystagmus extending through 5 generations is reported by Clarke. There were 23 cases, all males. In each generation there were several daughters, none of whom were affected; and only the eldest daughter transmitted the defect to her sons. In a family reported by Sinclair, one of two sisters had nystagmus, and 5 of their children were nystagmic.

MYOSITIS

The rarity of disease primarily affecting the ocular muscles is brought out by the reports of two cases. Gleason, under the title *idiopathic myositis*, describes the case of a

healthy farmer who had previously suffered from rheumatism. For several months he had recurring attacks of inflammation about the right eye, and later diplopia and dull pain. There were exophthalmos, chemosis, clouding of the cornea due to exposure, and iritis. Movement of the eye was very painful, and a hard mass was felt beneath the upper lid extending into the orbit. An exploratory incision revealed the enormously large superior rectus muscle. On account of impending panophthalmitis the eye-ball was enucleated. The other muscles were found to be normal. Two months later the patient returned with the other eye affected. The trouble having developed simultaneously with an attack of rheumatism. In spite of treatment with salicylates and moderate doses of iodide, vision was subsequently lost; and this eye, also, was enucleated. All its muscles were found increased in size, and showing the evidences of inflammation.

A case of *syphilitic* inflammation of the extra-ocular and heart muscles is described by Busse and Hochheim. It occurred in a woman aged 37, and terminated in death within six months after the first symptoms were noticed. The eye-balls were not seriously involved, and vision was normal to the end. The lids were swollen, the right eye, which was the more affected, was prominent. There was diplopia, and some pain in the right eye, although headache was more complained of.

Diseases of the Conjunctiva

BACTERIAL CAUSES AND CLASSIFICATION.—The period of transition from a clinical to a bacterial basis for the classification for conjunctival inflammations is likely to be a long one. Axenfeld, writing of the special bacteriology of the eyes, for a hand-book on pathogenic organisms, still employs a *clinical classification*. Under one heading, of pseudomembranous conjunctivitis, he discusses such different bacteria as the diphtheria and xerosis bacilli, and the streptococci.

He takes up first conjunctivitis of the Koch-Weeks bacillus. In the differential diagnosis of this disease he discusses influenza bacillus conjunctivitis, and L. Mueller's bacillus. Chiefly from the behavior in culture and inoculation experiments, he reaches the rather non-committal conclusion that these germs are very nearly related, that they belong to the same group.

Next diplo-bacillus conjunctivitis is considered. The diplo-bacillus differs sufficiently from the other bacilli found in the conjunctiva to render its identification comparatively easy. The pneumococcus seems to be the germ of nearest the same form frequently found in the conjunctiva, and its cultural and pathogenic characteristics have been fairly well worked out in other departments of medicine.

As above noted, Axenfeld considers the membrane-forming bacteria together. Blenorrhea and ophthalmia neonatorum are included in the same section, the gonococci and pseudo-gonococci claiming principal attention. Staphylococcus conjunctivitis receives separate recognition. Among the rarer observations are included conjunctivitis from the colon bacillus, the intra-cellular meningococcus, the ozena bacillus (Lowenberg), Friedlander's pneumobacillus, the capsulated mucous bacillus, and the bacillus subtilis. While not ascribing either of them to any specific organism, Axenfeld also devotes sections to scrofulous (phlyctenular, eczematous) inflammation, and trachoma.

Conjunctivitis occurring with an epidemic of *influenza*, chiefly in young children, has been studied by zur Nedden. He concludes that the inflammation is due to the influenza bacillus. But he finds in opposition to Jundell and Rymowitsch that this is not identical with the Koch-Weeks bacillus; the influenza rods being shorter and broader, and growing much more readily on culture media. Wynekoop also describes conjunctivitis due to the influenza bacillus, but without any observations as to its identity with the Koch-Weeks bacillus.

Hala has made an elaborate study of the *diphtheria* and

pseudo-diphtheria ("club forming") bacilli. He finds that the peculiarities of growth, and the effects of inoculation that have been used to distinguish between these, as different forms, are not to be relied upon. He concludes that the diphtheria, pseudo-diphtheria and xerosis bacilli are essentially the same organism.

Bietti made cultures and inoculation experiments with 100 cases of conjunctivitis, in which he found the *xerosis bacillus* or the diphtheria bacillus present in the conjunctival discharge. He found the virulent diphtheria bacillus was present only rarely in cases of catarrhal conjunctivitis; and that the xerosis bacillus was never pathogenic for the guinea pig. He concludes that he finds no positive proof that the non-virulent "xerosis bacillus" is the cause of simple catarrhal conjunctivitis, although in 12 cases his cultures showed no other organism. Randolph, in a case clinically indistinguishable from acute contagious conjunctivitis, was unable to find any micro-organism except the xerosis bacillus.

Poulard discusses *streptococcic infections* of the conjunctiva. He believes that they do not occur except when there is a pre-existing lesion of the conjunctiva. He would classify them according to their origin, into those arising from disease of the lacrimal passages; those developed in connection with infectious diseases, like measles, scarlet fever, and diphtheria; and those complicating other forms of conjunctivitis. Randolph thinks that all organisms found in the conjunctival sac "irrespective of their pathogenicity, require to some extent a helping hand to render them capable of doing harm."

As the cause of *trachoma*, L. Mueller again describes and argues at length the claim of a bacillus shorter and broader than the Koch-Weeks bacillus, with rounded ends, the colonies of which show glassy structureless edges, even with a magnification of 80 diameters. These bacilli are negative to Gram and show bi-polar staining, best with a watery solution of fuchsin.

When one studies at length these elaborate papers by bac-

teriologic experts who have devoted months or years to the investigations they report; when he compares their opposing conclusions, and the slight differences of appearance or cultural peculiarities on which their distinctions are based; when he considers the confusion that has arisen, such as that of which the so-called xerosis bacillus has been the center, he must be strongly impressed with the need of caution in the matter of accepting present views as to the pathologic significance of particular bacterial forms. What seems to be the most needed now is a sufficient number of very careful and minute observations of the clinical appearances and course of cases of conjunctivitis, with a careful study of the bacterial forms found in each. Every conjunctival infection is a culture experiment of the highest value and most direct significance. If the expert clinician and the bacteriologist work in close association, the present period of transition will end in more definite knowledge and a better classification of conjunctival inflammations than we yet possess.

OPHTHALMIA NEONATORUM.—*Arthritis* in connection with the purulent conjunctivitis of the new born, is occasionally mentioned in ophthalmic literature. But it would be more frequently found if carefully looked for and if the infant were watched for a longer period after the conjunctivitis had been cured. A tabular statement of 19 cases of the kind has been collected by Dahlstroem, including one of his own. These, with a case reported by Neuburger, make 20 cases reported from Europe, of which three each had come from two observers, Lucas and Hoeck. The joint affection began at the 8th to the 43rd day. The presence of the gonococcus was fully established in nearly all cases, and most of the cases had other lesions traceable to the same cause. Two of the cases terminated in death. All of the larger joints seem to have been affected, often two or more of them in the same case.

Morax finds that the larger proportion of cases of purulent conjunctivitis beginning during the first 8 days of life are due to the gonococcus. A few cases are due to other well-

known pathogenic bacteria, and in others we are not able yet to assign a cause. Haupt tabulates 62 cases, of which 58 began by the 8th day of life, the largest number, 28, appeared on the 3rd day. Of these, 45 were due to the gonococcus. These furnish 13 cases with corneal complications. The 17 cases in which no gonococci were found include only 2 cases of corneal involvement.

TREATMENT AND PREVENTION OF PURULENT OPHTHALMIA.—Vian again urges the treatment of purulent ophthalmia by concentrated solutions of *potassium permanganate*. He uses a 10 per cent solution, applying it to the inner surface of the lids, upon absorbent cotton, morning and evening. In a series of 53 cases, 7 of which were of purulent ophthalmia of the adult, all were treated successfully. However, he practices frequent cleansing of the conjunctival sac with boric acid solution, etc. The advantages claimed for this method of treatment are rapidity of cure, safety from damage to the cornea by even concentrated solutions, somewhat less pain than similar applications of silver nitrate, and that there is no danger of aggravating a diphtheritic inflammation if it should be submitted to this treatment by mistake. Fromaget uses a solution of $\frac{1}{4}$ to $\frac{1}{2}$ per cent potassium permanganate for the irrigation of the conjunctiva. Such solutions are not painful, and the discoloration of the skin caused by them can be removed by a solution of sodium bisulphite, 10 to 30 per cent.

The *subconjunctival injection* of sublimate solution, 1:2000, is advised by Speyr, who reports a case in which it seemed to check corneal ulceration. He also urges it as a prophylactic if, for example, the physician should receive a drop of the blenorrhoeic discharge in his eye. Darier reports a case in which purulent conjunctivitis in the infant, due to a streptococcus infection, was not helped by nitrate of silver or protargol, but was rapidly cured by subconjunctival injections of Roux's serum.

THE NEW SILVER SALTS.—But the popular movement in the matter of treating purulent conjunctivitis has been to-

ward the use of the new organic salts of silver. Veverka has employed protargol to prevent ophthalmia neonatorum. He uses the 20 per cent solution, and repeats the instillation if deemed desirable. He claims for it better results than have been afforded by the Crede method. Argyrol, as the least irritant of these newer preparations, seems likely to achieve the greatest popularity. The experience with it in the prevention of ophthalmia neonatorum is not yet extensive enough to establish its value. Indeed the reputation of this preparation seems to rest as much upon what has been claimed for it, as upon what it has accomplished.

A specious line of argument persistently urged on behalf of these silver preparations is that because they contain more silver, or because they penetrate more deeply into the tissues, they must be more efficient than the nitrate. Different combinations of the same element, especially mercury, may for certain purposes replace each other. Different compounds in a certain chemical series like the nitrites may do the same. But in those cases there is a general resemblance in their physiologic actions. There is no reason for thinking that silver compounds having totally different physiologic effects can be used interchangeably. Different chemical compounds, which have in common a markedly irritant effect upon the conjunctiva, are beneficial in certain forms of conjunctivitis. Chemical compounds producing a similar irritation might be expected to produce similar beneficial effects. But substances which do not produce any such irritation, should not be expected to produce the same benefit. The proposition that silver compounds which produce no irritation will be of no benefit in the treatment of purulent conjunctivitis, is, *a priori*, at least as reasonable as the assumption that they will be of benefit because they contain silver.

In fact there is no sufficient ground to justify either assumption. Nothing but clinical experience can settle the value of the newer silver salts; and with the exception of protargol, our clinical experience with them is yet too slight, too indecisive, and too much warped by enthusiast's expect-

tations to settle anything. Outside of the tissues, where efficiency has no relation to the tissue reaction produced, some of these less irritant silver compounds may prove of great value.

There is a need of something to replace *silver nitrate* for the prevention of ophthalmia neonatorum, since its use is not entirely free from danger. Wiener has reported an additional case of fatal hemorrhage from the conjunctiva, following the instillation of two drops of a 2 per cent solution of silver nitrate, in each eye, to prevent ophthalmia neonatorum. The bleeding commenced a few minutes after the application and continued until the infant's death, a week later.

VERNAL CONJUNCTIVITIS.—The hypertrophic masses formed in this disease consist largely of connective tissue, more or less infiltrated with leucocytes; and covered with a thickened layer of epithelium, which de Schweinitz and Shumway point out, sends processes of epithelial cells into the depth of the tissue, giving it a resemblance to canceroid.

Malone emphasizes the difference between this disease and trachoma in the distribution of the leucocytes. In vernal conjunctivitis they are diffused through the tissues, while in trachoma they are collected into distinct masses, and never invade the deeper fibrous layer of the mucous membrane. He finds, too, that the fibrous tissue of vernal conjunctivitis is a tissue with thick resisting bands, differing totally from the delicate bands of trachoma.

Herbert has observed that the round and oval cells which make up the chief mass of infiltration in the tissues, are in large proportion *eosinophile corpuscles*. The greater the infiltration present, the higher is the proportion of eosinophiles. They constitute the chief variable in the cells lying in the tissues. They lie near the surface of the elevations in the epithelial layer as well as below it. The infiltration is very marked in the more irritable stages of the disease. Actual breaches in the epithelium may then occur and the eosinophiles may be found in the exudation. Such exudation is

easily provoked, and the presence of eosinophile cells in it may be useful as a means of diagnosis. Herbert has also found the eosinophiles increased in the blood in his patients, to from 10 to 20 per cent of the total leucocyte count.

Posey has endeavored to determine certain points regarding vernal conjunctivitis by collecting the experience of American Ophthalmologists. He finds that while it differs in *frequency* in different localities, it is probably about as common in the large American cities as it is in Vienna, London, or Paris—about one case in 200 to 500 cases of conjunctival disease. The palpebral type is much the more common; 60 per cent, to 10 per cent that show the lesions limited to the ocular conjunctiva, and 30 per cent of mixed type.

The most *constant symptom* seems to be the milky film on the conjunctiva. But after the disease has lasted sufficiently long the granulations on the inner surface of the lid are usually present. In a few cases the disease is limited to one eye. It has been observed at ages ranging from 8 months to 60 years, but most frequently between 6 and 16 years. It is more frequent in males, in the proportion of 85 per cent to 15 per cent. The disease usually becomes less active after 6 or 8 years, but cases have been observed to recur for 16 and 18 years. In a few cases the disease appears to be hereditary.

In the matter of *treatment* there still seems to be the widest diversity of practice, no single remedy or method having proven sufficiently satisfactory to establish its claim to preference. Posey, however, is inclined to emphasize the experience of Starr and Bennett of Buffalo, who have had most excellent results from *X-ray exposures*.

Allport reports a case of cure, at least for the time being, by this method. His patient had suffered for 7 years, had consulted specialists both in America and in Europe, and had been treated by Allport by ordinary methods the preceding year, without much relief. The X-ray was tried. The exposure at first lasted only 2 or 3 minutes; but as no harm

was done were later prolonged to about 10 minutes. The patient was at once relieved of photophobia, redness, itching and irritability of the eyes. The treatment having been begun the middle of June, she passed the remainder of the summer in perfect comfort. The palpebral growths gradually diminished; and after some 80 exposures, had entirely disappeared, leaving the lids smooth with apparently harmless cicatricial tissue. For details of the use of the X-ray see article on the treatment of trachoma.

PARINAUD'S CONJUNCTIVITIS.—Jocqs and Darier each report a case of this disease presenting its usual characters. Jocqs secured rapid healing by the use of the galvano-cautery. Darier on curetting the cavity of the suppurating preauricular gland obtained growths which he considered identical with those of the conjunctiva.

A third case reported by Chaillous and Toufesco, and studied by Morax and Manouelian is of great interest. Contrary to all previous observations both eyes were affected. But the case was seen by Parinaud, who concurred in the diagnosis. Some 18 days before the beginning of the ocular trouble, the patient suffered from a boil on the forearm. He was employed at making brooms, and two fellow workmen in the same shop presented similar boils; one on the forearm, the other on the temple and chin.

In this case bits of tissue from the conjunctival lesions and the diseased glands were inoculated in the abdomen of the guinea pig, in the anterior chamber of the rabbit and upon culture media. In every case the results of these experiments were negative. The microscopic examination showed a sub-epithelial zone of diffuse infiltration, quite different from the infiltration of trachoma, and an absence of the giant-cells and bacilli of tuberculosis. In reporting a case of conjunctival tuberculosis I have pointed out its close resemblance clinically to Parinaud's conjunctivitis. But the histological findings and the negative results of inoculation in Morax's case make it pretty certain that Parinaud's conjunctivitis is not tubercular.

TRACHOMA.—In a discussion of trachoma before the Ophthalmologists of the Rhenish Provinces and Westphalia, Pfalz took up those cases which give the history of *local injury* as the beginning of the eye trouble. Sometimes it is evident that the injury has merely attracted attention to the condition of the eye; as where one eye has recently been injured, yet upon everting the lids, both present the changes of advanced trachoma. In other cases, however, an accidental injury may seem pretty clearly to be the starting point of unpleasant symptoms, or of corneal complications. Pfalz suggests that in connection with every injury to the eye, the condition of the conjunctiva should be carefully noted. In this way positive evidence bearing upon the subject may be obtained.

The nature of *Egyptian ophthalmia* was pretty well determined years ago; but there have been enough dissenters from the general verdict to stir up a new discussion of it, at the late Congress of Egyptian Medicine. The general conclusion is stated by Baudry thus: The name "Egyptian Ophthalmia" has been improperly given to trachoma complicated by catarrhal or purulent conjunctivitis. Except that these complications are more common, the trachoma of Egypt is absolutely identical with that of Europe. Its greater frequency is explained by the climatic and hygienic conditions of the country.

How great that frequency is, the extensive statistics given by Eloui-Bey illustrate. In the "koutabs" of Cairo, the schools of the poorer class, in 1898 out of 3400 children 3290 had trachoma—96 per cent. But even in these schools the percentage had fallen in three years to 85 per cent. In the government schools of Cairo the percentage of cases has diminished from 85 per cent in 1884, to 34 per cent in 1900, showing that even in Egypt proper hygienic precautions can greatly diminish the disability and blindness from this source. Probably the percentage which still remains in these schools depends upon the constant influx of new cases from the general community; like the 2 to 8 per cent of cases

that still appear in the New York asylums, in spite of the most rigid care within these institutions.

SURGICAL TREATMENT OF TRACHOMA.—The more severe surgical methods of treating trachoma still claim considerable attention. Wood describes the *exsection* of the "so-called tarsal cartilage," following chiefly the method of Kuhnt. The Germans commonly do the operation under local anesthesia with cocaine, but Wood insists upon a general anesthetic. Not only is the operation painful; but its success depends largely on precision, which is difficult or impossible to attain when the patient is restless. Wood points out that such an operation is not indicated in recent or acute



Fig. 9—Cohen's Trachoma Forceps.

forms of trachoma. Nor would he advise it in any case where there is reasonable prospect of early cure from any other form of treatment.

Treatment by *scarifications and brossage* has been found satisfactory in Cairo by Chadoudi. Perhaps in that stronghold of trachoma there are circumstances by which it is justified. But the results of *expression*, particularly with Knapp's roller forceps, are so much better as regards cicatricial contraction of the lids; and being as promptly attained, the tearing of the conjunctiva to shreds with a stiff brush ought to be abandoned where expression is possible. New forceps for the expression of the trachoma granules have been described by Cohen. They may be more convenient for getting into the angles of the conjunctival sac, but it is hard to see how they can be more efficient than the roller forceps without causing more injury.

MEDICAL TREATMENT OF TRACHOMA.—Exactness of dosage, greater safety and therefore a wider range of applica-

bility are urged as reasons why Merck's *jequiritol* should replace other preparations of jequirity. It is furnished of 4 different strengths; numbers 1 and 2 producing but little irritation, 3 and 4 being progressively more active. Coppez begins by using 10 milligrams of No. 3. The second day he uses 20 milligrams; the third, 30; and the 4th, 40. On the 5th day he begins with 10 milligrams of No. 4, and increases the dose from day to day in the same manner, until sufficient reaction is produced. Usually the third dose of No. 3 is followed by a reaction which keeps the eye painful for some hours. The lids become swollen; but Coppez has never seen the cornea involved, or the neighboring glands affected. By this treatment acute exacerbations of trachoma may be relieved in 10 to 12 days. But operative treatment is generally required to effect a permanent cure.

The value of *copper citrate* (cuprocitrol) in the treatment of trachoma is strongly attested by Bock. In 58 cases, including the most varied and grave forms of trachoma, 38 were cured or improved. The best results were obtained in chronic cases. Bock used the drug in a salve containing 10 per cent, which was placed in the conjunctival sac and allowed to slowly dissolve. In no case was there complaint of serious pain.

Copper citrate has also been used by Wright, who endorses Arlt's statement that it does not cure trachoma more quickly than other non-operative methods. But he claims that it produces absorption and disappearance of the granulations quite as rapidly as other applications; and produces less pain and discomfort to the patient. On this latter account it is possible to get it used more regularly and effectively in home treatment. In 7 months' experience with the drug, Wright reports 9 patients discharged cured; and 6 still under treatment, progressing favorably. He employs it in 5 per cent or 10 per cent ointment, commencing with the former, having it introduced at bed-time and allowed to remain in the eye through the night.

Applications of *copper sulphate* to the lids, it is claimed by

Ginestous and Liaguet, can be rendered painless by employing a crayon composed as follows: Copper Sulphate 100, Orthoform 50, Holocaine Hydrochlorate 40, and Gum Tragacanth 10. Used in this way the blue stone is said to be as effective as in crystal, and the patient is not deterred from treatment by dread of suffering.

Some of the earlier reports rather discredited *protargol* as a remedy for trachoma. But it certainly is not without value early in the disease, and in the milder cases. Ripperger has used it in a 2 per cent solution, instilled thrice daily, and finds that it causes rapid diminution of the secretion, and that the hypertrophy of the conjunctiva soon subsides under its use. Darier has formed a similar estimate of its value. It should be used in solutions freshly made with cold water.

The prevention or cure of the corneal ulcerations of trachoma Kalt believes is best accomplished by free irrigation with a 1:3000 solution of *potassium permanganate*. The solution should be lukewarm, and from 1 to 3 pints employed at each irrigation. In case of painful blepharo-spasm, the first irrigation should be preceded by use of a local anesthetic. The washing is to be repeated morning and evening. It does not effect a cure or remove the granulations; but it improves the catarrhal condition, on which Kalt believes corneal ulceration depends.

X-RAY TREATMENT OF TRACHOMA.—Many an ophthalmologist has wished for a specialist to whom he might refer at least some of his cases of trachoma. The long-felt want may be met by the Roentgen-ray operator. At least all the experience thus far reported seems to point in that direction. Mayou says that with the X-rays we can set up a leucocytosis with minimum destruction of epithelium and other tissues. The process may be made to vary from the slightest disturbance of nutrition to actual gangrene; and it is under good control by the experienced X-ray operator.

From an experience of 15 cases Mayou claims that the X-ray treatment has these advantages over other methods: (1) There results less deformity of the lid; (2) it is practically painless; and (3) pannus clears up more thoroughly.

Stephenson and Walsh treated 4 boys presenting typical trachoma, equally severe in the two eyes. To cure them with the ordinary methods of treatment would have required one and a half to two years. In three of them but one eye was subjected to X-ray exposures, the other eye receiving the usual treatment for trachoma. Of the five eyes subjected to the X-ray exposures 2 appeared completely cured after 16 and 17 exposures respectively; while the other 3 were greatly improved, and seemed to promise complete cure. Bettremieux reports equally favorable results.

Mayou used a moderately "soft" tube, and a current of 6 amperes. The patient was placed 9 inches from the anode; and the exposure limited to 2 minutes. Such exposures were repeated daily for 4 to 6 days; then omitted for a week, and afterwards made twice a week or at longer intervals. At first he covered the face, except the affected eye, with a metal mask. This was afterward discarded. No unpleasant effects were observed, except that in his first cases there was some falling out of the lashes and slight conjunctivitis.

Stephenson and Walsh used a "hard" tube, having a resistance equal to a 7 or 8 in. spark: with a current of 5 amperes, and 20 to 25 volts. The eye was placed 8 inches from the anode, and the exposure continued to 10 or 15 minutes. These exposures were made at intervals of at least 5 days, but they caused on several occasions "slight superficial dermatitis" of the lids. And a 4-inch exposure caused a moderate dermatitis on the fingers and back of the hand of the nurse, who held the lids everted. In one case a blister was caused on the lid. This led them to employ a lead mask for this particular patient.

Bettremieux used a current of 3 or 4 amperes and 16 volts, with the eye at 4 to 10 inches from the anode. His exposures were short, and repeated 4 or 5 times a week. They produced no unfavorable effects. Stephenson and Walsh treated 3 of the 5 eyes without eversion of the lids, and thought these did as well as the eyes which had the lids everted during the exposures. Bettremieux concluded that

some cases did as well without eversion of the lids; but that others did better if the lids were everted. Mayou finds that the treatment is especially suited to the chronic cases, altho the earlier they seek treatment the more rapid and satisfactory the result. The acute diffuse infiltrations require more care about the exposures.

Stephenson and Walsh report a cure of severe trachoma by 22 applications of the *high frequency current* through a vulcanite electrode applied to the upper lid. They employed the D'Arsenval apparatus, using a coil that gave a 12-inch spark.

LARVAL CONJUNCTIVITIS.—Inflammation from the presence of larvae in the conjunctival sac has been reported from time to time. Lotin reports the case of a boy three years old, the son of a peasant, in whom he found 10 larvae, each about 5 mm. long and 1 mm. in thickness, embedded in the right conjunctiva. There were symptoms of severe, acute conjunctivitis which had been noticed for two or three days. These symptoms quickly disappeared after the removal of the worms. The extracted larvae were submitted to an entomologist, J. A. Portschniski, and were pronounced none other than those of Wolhart's fly. This fly is so named because Wolhart reported in 1770, a case in which 18 of the larvae had developed in the nose. The habits of the fly are such that the eggs are only likely to be deposited on persons sleeping outdoors in the hottest part of the day.

TUBERCULOSIS.—Tuberculosis of the conjunctiva assumes somewhat varied forms. In the case which I have reported the appearance of the everted lid differed from that usually described and figured. It presented much apparently fatty, necrosed tissue, almost white in color, with granules, each of which had a gray translucent center, with minute vessels entering it from a surrounding vascular zone. The appearance was quite unlike anything seen in trachoma; and more nearly resembled what is sometimes observed in lupus of the skin. The resemblance of this case to Parinaud's conjunctivitis was striking; and this is true of many cases of conjunctival tu-

berculos's. In this case the tubercle bacilli, although few, were repeatedly found in the conjunctival discharge.

This affection is almost always seen in children or young adults. But Terson has placed on record a case occurring at the age of 71 years. The tubercular character of the lesion was demonstrated by inoculation of a piece of the tarsal conjunctiva in the abdomen of the guinea pig. There was no evidence of previous tuberculosis.

The only actual local *treatment* resorted to in my case was the use of a 25 per cent iodoform ointment. Henderson has reported a case in which after demonstrating the tubercular character of the lesion by inoculation of the guinea pig, and microscopic examination of tissue removed, the patient was merely put upon the general treatment for tuberculos's, including removal to Colorado; and within 6 months the conjunctival lesions were completely healed.

From the experience of the healing of lupus by *X-ray exposures*, and the Finsen ultra-violet rays, there is every reason to suppose a conjunctival tuberculosis may thus be cured. Stephenson reports the case of a girl aged 4, who was practically cured in a month by 9 exposures to the X-rays, at a distance of 6 to 10 inches, for 10 minutes at each sitting. In view of these facts are we not justified in thinking that the time for removal of the diseased tissue by cutting and scraping may be passed? Berry reports a case in which the whole tumefied conjunctiva was removed and the sub-maxillary glands dissected out. There was also subcutaneous swelling of the facial lymphatics, which were opened and scraped. Berry's case did well, but it seems probable that equally good results can be obtained by methods less severe and less dangerous. A meningeal or general tuberculosis is far more serious than the tubercular lesions of the conjunctiva. And cutting or scraping operations can scarcely fail to favor extension of the tubercular process, if indeed it be not already general, as it certainly is in most cases.

GUMMA OF THE CONJUNCTIVA.—Cirincione reports the case of a boy of 15 with a fleshy gelatinous mass connecte

with the bulbar conjunctiva, and covering the outer half of the eye-ball. On the supposition that this mass was tubercular it was removed. But inoculation experiments and microscopic examination seemed to show that it was not tubercular but probably a gumma. The patient's father had suffered from syphilis. After the removal of the conjunctival growth the palate began to soften and break down; and by energetic treatment with potassium iodide, this process was promptly checked.

CYSTS IN THE REGION OF THE CARUNCLE.—Cysts of the conjunctiva may be congenital or traumatic in origin. A case of the latter kind is reported by Lange. Or they may arise in connection with the lymphatics or the glands of Krause, or with pterygium. Two cases of cysts arising from degenerative changes in the region of the caruncle are reported by Rumschewitsch. Both cysts were removed and studied microscopically. The first case was one of chronic trachoma, in the stage of cicatricial contraction. The cyst in the larger (vertical) diameter measured 10 mm. It was believed to have arisen by degenerative changes in a gland, or glands, infected by trachoma. The second patient when seen two years previously, had been suffering from hyaline degeneration of the conjunctiva. The cyst in its long diameter (vertical) measured 15 mm. A mucoid degeneration seemed to have occurred in an obstructed gland, or glands. The removal of these cysts was followed by no complication or recurrence.

POLYPS OF THE CONJUNCTIVA.—These are mentioned in most works on ophthalmology, and often with a good account of their histology, clinical characteristics and methods for their removal. But, as Deschamps points out, the important point of their causation, which he finds to be usually dependent on the *presence of a foreign body*, is ignored. The presence of a polyp demands careful search for the foreign body causing it. These growths usually occur in children, and no history pointing to the presence of a foreign body can be obtained from the child or its caretakers. The original

accident has caused but slight irritation; and has been forgotten before the growth appears, which attracts attention. The offending particle is often very small; and may be removed along with the growth, without being noticed. Deschamps reports two cases in which it was larger. In one it was a piece of wood, 7 or 8 mm. long and embedded 1 cm. below the surface. In the other it was a hard scale of a fruit bud, which had certainly been lodged beneath the upper lid for more than a year.

A striking case of the kind is reported by Neeper. A piece of broom straw, $7/8$ of an inch in length, had been lodged in the lower sac of the conjunctiva of a school girl, for 8 weeks. During that time she had glasses from an optician; and treatment for conjunctival disease from a general surgeon. There were three polyps; one at each end of the straw, and a third where it rubbed against the eye-ball. Probably, as Weeks points out, polyp of the conjunctiva always indicates an ulcerative process. But far more frequently than has been suspected, the origin of the ulcerative process is a foreign body in or beneath the conjunctiva.

Diseases of the Cornea

RING ABSCESS.—Under the name of ring abscess of the cornea Fuchs has described a form of disease characterized by sudden infiltration of the cornea, the exudate being distributed in a zone concentric with the corneal margin. The case rapidly goes on to softening of the cornea, and panophthalmitis. Fuchs reported 9 cases. Three had suffered recent wounds near the center of the cornea, Fig. 10; two had wounds nearer to the corneal margin, Fig. 11; three were cases of recent cataract operation with the incision in the corneal margin, below in two, Fig. 12, and in one at the upper edge of the cornea. One case had suffered no recent injury, but the eye presented an adherent leucoma from a punctured wound received three years before.

The principal zone of infiltration lay in the middle and superficial layers of the cornea. A second zone of infiltration was situated close to Descemet's membrane. The ring at first appeared gray, and later yellow. It was about $1\frac{1}{2}$ mm. wide and the same distance, or a little less, within the corneal margin. The seat of the wound and the exudation are shown in the accompanying figures.



Fig. 10.



Fig. 11.

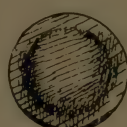


Fig. 12.

Ring Abscess of the Cornea. (Fuchs).

The zone of purulent infiltration in the cornea appeared to be free from bacteria, but in the exudates from the interior of the eye bacteria were found in great numbers. Fuchs found no particular form common to many or all of his cases; both bacilli and cocci were usually present. In a case reported by Hanke, in which the injury was by a splash of hot oil, there was found a bacillus hitherto undescribed, which proved highly pathogenic. Fresh cultures inoculated into the cornea or introduced into the aqueous humor of rabbits or guinea pigs caused a zone of infiltration 1 mm. within the limbus, followed by softening of the cornea, panophthalmitis and shrinking of the globe. Inoculated into white mice they proved fatal in one or two days. The rods were .8 to 1.6 microns in length and .3 in thickness. They stained with the ordinary analine colors, but not by Gram's method. The organism grew on potato, on bouillon and on agar media. It rapidly liquefied gelatin and blood serum. In old cultures it showed fluorescence.

Hanke's observations are opposed to those of Fuchs in that he found the bacillus in the scrapings from the cornea of his patient, and also in the infiltration zone produced experimentally. It would be very hasty to assume that this organ-

ism was the specific cause of the pathological condition under consideration. Even if it were admitted to have been the cause in Hanke's single case, the peculiar distribution of the exudate and the characteristic unfavorable course of the affection might be due to the severity and wide extension of the infection in these cases, rather than to the properties of a special organism.

SERPENT ULCER.—This is a lesion which appears to be caused by more than one specific form of bacteria, although in a large proportion of cases the pneumococcus is the offending organism. Kruger reports a case in which smears and cultures showed a straight bacillus with rounded ends, measuring 1.75 to 4.5 microns in length and .75 to 1.3 in thickness. Cultures of this bacillus injected into the cornea of the rabbit caused marked infiltration. In the anterior chamber they caused general hyperemia of the conjunctiva and peri-corneal zone, and closure of the pupil by exudate. In the vitreous they caused the formation of pus; and from it a pure culture of the bacillus was obtained.

TRAUMATIC ULCERS.—Suppurating ulcers of the cornea, due to traumatism by heads of wheat, branches of trees and chips of wood, are extremely common in the Southwest of France. Roullies has found that they are best controlled by early *iridectomy*. He finds this more effective than cauterization, paracentesis or the Saemisch incision; and advises, when these therapeutic procedures are not followed by improvement within 24 hours, that *iridectomy* should be done. He reports 9 cases subjected to *iridectomy*, all of which had shown temporary improvement and relapse after cauterization, and some of them also after paracentesis. All did well after the *iridectomy*. The upper portion of the iris was removed, and usually rather a large segment.

SERUM TREATMENT FOR HYPOPION KERATITIS.—Darier's case of streptococcus infection has already been referred to. (See page 68.) The literature of previous years indicates that the value of this method is somewhat uncertain. When resorted to early it has seemed distinctly beneficial. After

the first few days, all agree that it is quite useless. Indeed, the most hopeful view regarding it has been of its use as a prophylactic, after injuries such as are very generally followed by suppurating ulcer.

The experience reported by Calderaro points in the same direction. He has used the antipneumococcic serum of Tizzoni-Panichi. This he prefers on account of its greater strength, and because it can be kept in the form of a powder, and prepared for use by addition to distilled water. He employed it by subconjunctival injections on alternate days, and by instillation into the conjunctival sac every two hours. When this treatment was begun not later than the 4th to the 6th day of the ulcer, it proved decidedly beneficial; although it did not prevent the need for operative interference, cauterization and the Saemisch incision, in some cases.

OTHER TREATMENT FOR INFECTIVE ULCERS.—In all corneal ulcers, no matter what their origin, if they appeared severe enough to require more than a mild cleansing lotion, Donovan has instilled holocain, cleaned out necrotic tissue with a curette, and used the *electro-cautery*. The point was usually heated to a dull red and in ordinary cases the lightest possible punctures made all around the edge of the ulcer, just in the healthy cornea, and about $1\frac{1}{2}$ to 3 mm. apart. Any part of the floor of the ulcer which appeared unhealthy was also touched. If after 2 to 4 days some parts appeared to have made no progress toward healing, these spots were re-touched. If the ulcer continued to develop in some direction, the advancing edge was similarly treated.

Donovan, in a large experience with traumatic ulcers, had formerly employed the usual methods of treatment, using the cautery as a last resort. It proved so reliable in that way, that he was induced to use it at first. The method of puncture around the edge of the ulcer he credits to H. Knapp. (Archives of Ophthalmology, Jan., 1901, p. 80.) Hermann, reporting upon the methods of treatment used at Bonn, gives the preference to incision of the cornea, and the second place to the cautery.

The value of *trichloroacetic acid* in the treatment of infected ulcers of the cornea is attested by Bulson. He reports 2 cases of rapid recovery after its use. He employed it in 20 per cent solution; which, notwithstanding cocain anesthesia, caused some pain. He considers it superior to pure carbolic acid, safer than the galvano-cautery and more efficient than curettage.

MOOREN'S ULCER.—To the disease which he described, Mooren applied the name Rodent Ulcer. But among English speaking people, the term "rodent ulcer" has become so generally associated with the skin lesion known by that name, that it seems best to follow Nettleship in designating this form of corneal ulcer by the name of its discoverer.

It is said to be relatively common in Japan. Asayama reports 4 cases seen within two years, among less than 7000 patients. One eye he enucleated for pain, and found the affected portion of the cornea only $\frac{1}{3}$ to $\frac{1}{5}$ the normal thickness. Lister, who also reports the anatomic examination of such an eye, found the depth of the ulcer and its undermining edges to be the most striking features. In his case the depth varied from $\frac{1}{3}$ to $\frac{1}{2}$ the thickness of the cornea, while the edges of the ulcer were undermined from $\frac{1}{2}$ to 1 mm. The tissue overhanging these edges included $\frac{1}{3}$ to $\frac{1}{2}$ the thickness of the cornea. It would seem then that the tissue really attacked in this form of ulcer is not the superficial, but the middle layers of the cornea. The real depth of the ulcer is partly concealed by the bulging forward of its thin floor. Some of Lister's sections also showed that the process was attacking parts of the cornea which had already undergone cicatrization.

A case of very chronic ulcer—lasting 23 months, and then not healed—is reported by McKeown. He does not class it as one of "rodent ulcer," but there seems no sufficient reason for regarding it as essentially different. The whole surface of the cornea had become involved by successive extensions. In contrast with this case, one of Asayama's cases reached involvement of the whole cornea 10 days after the ulcer was

first noticed. No improvement in treatment has been suggested.

KERATOMYCOSIS.—Two cases of this disease have been reported during the past year. In one, reported by Wicherkiewicz, the eye had been struck by a bit of dirt, while digging potatoes 3 weeks before. The center of the cornea presented a tough, yellowish white, homogeneous mass, nearly round, having a diameter half that of the cornea, and with an elevated uneven surface. This mass was firm, and so resistant that it could not be removed with a sharp spoon, and a Graefe knife had to be used. The fungus proved to be "*penicillium glaucum*."



Fig. 13.—*Aspergillus* Keratitis. Kayser's Case.

Kayser reports a case in which something was known to have flown into the eye 14 days before. The general appearance is shown in the accompanying illustration. The grayish spot was cut away; and by culture it was demonstrated to consist largely of the *Aspergillus Fumigatus*. Kayser also brings together abstracts of 5 other cases, reported since Uhthoff and Axenfeld collected the cases then known, in 1896. These make 13 cases in all. But Kayser has failed to note the case of corneal disease due to *Aspergillus Niger*, reported by Ellett. (Ophthalmic Record, November, 1902.)

BULLOUS KERATITIS.—This name has been used to designate cases that fall into at least two rather distinct classes. First, of eyes that have been greatly damaged by chronic glaucoma, irido-cyclitis, etc.; and second, eyes that have met

with injury causing removal of a certain part of the corneal epithelium; but which apart from the condition under consideration, and the pain which attends it, may appear to be normal.

De Schweinitz and Shumway report the clinical histories and anatomic conditions of two eyes belonging to the former class. Both eyes were blind; one from chronic primary glaucoma; the other from a foreign body in the eye, iridocyclitis, and secondary glaucoma. In both there had been many attacks of pain, with the formation of blebs upon the cornea. Of their anatomic findings these authors emphasize the change in the form of the basal epithelial cells, and their consequently less firm attachment to Bowman's membrane. It is quite noticeable in one of the figures which they publish that where Bowman's membrane had been destroyed by ulceration, the epithelium remained firmly adherent. They seem to favor the view of Fuchs that pathologic changes may allow the passage of fluid from the anterior chamber, through the cornea to the sub-epithelial space.

Stood has published a paper dealing with the clinical aspects of the second class of cases. He has recognized about 60 of them among 40,000 cases of eye disease. The beginning was always a superficial injury of the cornea, involving removal of the epithelium. After this had been, apparently, fully repaired for a period varying from some weeks to six months the patient suffered an attack. Pain was first noticed on awakening from sleep. The patient would feel that the lid was adherent to the eye-ball. If the eye were forced open there was the sensation of something being torn away. Whether the wound had healed under a pressure bandage or without treatment made no difference as to these recurrent attacks.

Stood believes that the epithelium is imperfectly regenerative and not sufficiently adherent to Bowman's membrane; and that it adheres to the lid during slip, and is thus pulled away from the normal attachment. He thinks that the detachment of the epithelium leads to the accumulation of fluid

beneath it, rather than that the pressure of fluid in the edematous cornea causes the detachment. Upon this view Stood bases his treatment. He says that in 13 years in which he has used it, the recurrences have been few and not severe. Rarely have there been more than 2 or 3 attacks; often but one if the treatment was carried out properly. He prescribes a salve to be used in the eye, either 1 per cent of yellow oxid of mercury ointment, or boric acid in lanolin. This is to be applied with massage at bed-time; and when the patient awakes, mild massage of the upper lid, and then of the cornea through the upper lid, is to be performed. He thinks that this treatment prevents the adhesion of the corneal epithelium to the lid, and also favors a better development of the epithelium, and a firmer connection of it with Bowman's membrane.

Peters traces certain resemblances between bullous keratitis, traumatic erosions, serpent ulcer, and herpes of the cornea. In all of these affections he believes there are degenerative changes in the corneal epithelium, permitting its easy separation from Bowman's membrane. He finds that the disturbances of sensibility, anesthesia and hyperesthesia, point toward lesions of the peripheral nerves, which may cause edema of the cornea and loss of the epithelium. He is inclined to direct treatment to the supposed abnormality of the nerves.

CORNEAL ERUPTION OF MEASLES.—Examining closely for corneal lesions all cases of measles coming under his observation, Trantas (Constantinople) found out of 41 cases, 31 presented superficial lesions of the center of the cornea, of very brief duration. Trantas uses the term superficial punctate keratitis to designate them, and it is quite descriptive of what he observed. But the condition occurring in measles is totally different in its course and prognosis from that which has commonly been designated by that name. So common did he find corneal changes, and so commonly did the corneal disturbance terminate with the general symptoms, that Trantas suggests that it should be regarded as a

symptom of the disease rather than as a complication. This is quite appropriate since the part of the cornea involved corresponds closely to the skin of the general surface.

He describes in detail three cases, typical of all that he observed. In the first, the corneas appeared normal to ordinary inspection, but by oblique illumination a great number of small gray points were found in the superficial layers near the center of the cornea; and the epithelium of this portion of the cornea was wrinkled and clouded, but was not lost. The sensibility of the cornea was normal. The photophobia and lacrimation were annoying, but vision was not impaired. When first seen the photophobia had lasted for one day. Two days later the cornea had become quite normal. In another case vision was reduced to $1/3$ and $1/4$; and the sensibility of the cornea was blunted. In six days all evidence of the trouble had disappeared. In a third case there was neither photophobia nor lacrimation, and in 4 days the recovery was complete.

The corneal trouble seems to have arisen during the early days of the eruption, on or before the fifth day. In no case did it precede the rash. In this it differs from the usual conjunctival symptoms of measles, which Morax found to precede the rash in 12 out of 22 cases. It differs also from herpes of the cornea; in being bilateral, and in the fact that there is no loss of substance. From chronic superficial punctate keratitis it differs in that the single spots are very much smaller; and in its brevity, as against the many weeks or months that affection takes to run its course. The prompt recovery mentioned occurred without any special treatment.

Trantas discovered a similar eruption in one case of *scarlet fever*, out of eight which he examined for it. He has reported (*Annales d'Oculistique*, May, 1900, p. 390) 4 cases of this condition of the cornea accompanying *rubcola* in which the corneal lesions also terminated promptly in complete recovery.

INTERSTITIAL KERATITIS.—The *corneal sensibility* in this condition is found by Golesceano to vary remarkably.

Sometimes there is anesthesia of the central portion, or there may be insensibility of the upper or the lower margin, or of both, while the center of the cornea remains sensitive. Again, the anesthetic areas may be lateral, or bilateral. He finds the existence of anesthesia of some prognostic importance.

The state of the *knee-jerk* in patients suffering from interstitial keratitis due to congenital syphilis, has been tested by Harman. He found, in opposition to previous writers on the subject, that in 100 cases of this form of keratitis the knee-jerk was "absent," "reinforced," "subnormal," "normal," "brisk," "exaggerated" or "violent," in almost exactly the same proportions as among 100 normal persons of the same age. Among the cases of keratitis the reflex was recorded as "normal" in 75. Among 100 healthy individuals, it was considered "normal" in 74.

Using interstitial keratitis with other common symptoms as evidence of inherited syphilis, Collins has investigated the subject of *sterility and the health of children* born of women who had suffered from this disease. He was able to follow out the cases of 12 women who had 60 children, and 5 miscarriages. Twenty-six of the children had died. Of the 34 living, 25 were said to be healthy; and 14 of these, which were examined by Collins, appeared to be in excellent health and free from all deformities. He concluded that it is certainly possible for women, the subjects of inherited syphilis, to have healthy children free from all taint of that disease.

Punctate Interstitial Keratitis apparently due to hereditary syphilis is reported by Inouye. The opacities were scattered through the deeper two-thirds of the cornea. They consisted of a few larger spots and countless minute areas. There were no inflammatory symptoms. Vision was reduced to 6/40, but again became normal with the clearing of the cornea.

INTERSTITIAL KERATITIS DUE TO ACQUIRED SYPHILIS is probably not very rare—not rare enough to justify the recording of each single case, although so uncommon that few

surgeons have been able to record any considerable series of cases. Stephenson reports one of the punctate form described by Mauthner, of which he has failed to find any instance in British ophthalmic literature. The tiny, gray spots were scattered deeply in the substance of the cornea, the epithelium showed no changes. The eye flushed under examination, but was otherwise free from redness. The cornea cleared and vision became normal after six weeks' treatment with mercury.

Stephenson also reports two cases of the more ordinary form of interstitial keratitis apparently due to acquired syphilis; and brings together statistics of 395 cases, among which 4.7 per cent seemed to be due to the acquired form of the disease. He thinks it probable that some of the cases regarded as hereditary are not such, the disease having been acquired in early childhood.

INTERSTITIAL KERATITIS IN THE NEW BORN.—A case reported by Hubbell seems to throw some light on those cases of ophthalmia neonatorum, in which the cornea appears to be damaged in spite of careful treatment. It also suggests the relationship between keratitis and congenital opacities. An infant 6 days old developed purulent ophthalmia, which was promptly treated by frequent cleansing and applications of silver nitrate. On the 4th day of the disease slight cloudiness was noticed at the center of the cornea. Two days later the other eye became affected. Fearing it might cause corneal opacity, no silver nitrate was used in this eye. But 4 days later its cornea also was clouded. The conjunctivitis ran its course within 5 weeks; but the corneas continued to become more opaque, and the attending peri-corneal hyperemia remained. The keratitis seemed to reach its climax in about 2 months. After a year the corneas slowly began to clear, and at 10 years old the boy could read with one eye, and count fingers at one-half meter with the other. The only family history seeming to point to syphilis was that a brother 2 years older, and otherwise healthy, had recently (at the age of 12) suffered almost total loss of accommodation.

EXPERIMENTAL TOXIC KERATITIS.—The dog is extremely liable to corneal inflammation and opacity. Terrien, in experiments with tetanus antitoxin injected into the vitreous of a dog, noted the rapid development of interstitial keratitis. Pechin, experimenting with the bacillus of septicemia on the guinea pig, produced with the usual general symptoms, a panophthalmitis in one eye, and interstitial opacity of the cornea in the other.

TUBERCULAR INTERSTITIAL KERATITIS.—Tuberculosis stands next to syphilis in importance as a cause of interstitial inflammation of the cornea. Desvaux reports two cases in boys of 10 and 12 years, both suffering from tuberculosis of the knee. One who had lost an eye from buphthalmos, came under observation at the very onset of an attack. The trouble began with slight hyperemia; and in two weeks the cornea was clouded and vision almost lost. Little white deposits appeared near the lower margin of the cornea, close to the anterior chamber. These deposits Desvaux has always found in interstitial keratitis of tubercular origin; but never in that due to syphilis. Chiefly under general treatment, the cornea cleared up until vision of $1/6$ was regained.

A more serious case was reported by Darier to the Section of the British Medical Association. After many months of varied treatment, with alternate improvement and relapse, the *subconjunctival injection of tuberculin* T. R. was decided on; in the hope that in addition to its diagnostic and general therapeutic value, it would provoke a local reaction that would improve the condition of the cornea. Without any rise of temperature, there was a most violent local reaction. The eye was swollen, chemotic, of a purple red, and vessels invaded the cornea nearly to the center. Darier feared phlegmon of the orbit. By the 16th day vision had risen from $1/200$ to $1/120$; and at the end of a month to $1/25$. The amount given at this first injection was $1/20$ of a milligram. Subsequently, injections of $1/100$, $1/50$ and $1/30$ mg. were given, and vision rose to $1/12$. Attempts to draw off fluid from the anterior chamber caused diminution

of vision to $1/40$. Additional injections were given, with other treatment, and $V=1/15$ was regained.

RHEUMATIC SCLERO-KERATITIS.—Asmus believes that the disease, as described by Pfalz, is a true clinical type; and one in which an early diagnosis is of especial value, because of its prompt response to treatment with sodium salicylate. He reports 13 cases seen in three years; and thinks the climate of Dusseldorf may account for this large number, since they occur mainly during the cold wet season, only one having been observed in midsummer. Two of the patients were 27 years old; 3 were between 40 and 50; and 8 between 50 and 74. Four were men; nine women. Ten of the 13 patients had the pains and body posture of chronic rheumatism. Three of the cases were complicated with iritis; and in a fourth there remained adhesions of a former iritis.

The characteristic corneal lesion was situated near the corneal margin, but separated from it by tissue that was normal, except that it was crossed by fine vessels. The epithelium over the affected region was commonly stippled. There might be a single focus of inflammation, or more than one. These foci might be arranged in a chain; or confluent, forming a larger focus. The color of the spots was porcelain white. Their position was usually deep in the substance of the cornea. Some were more superficial, and their color faint gray. Spots of this kind might be taken for corneal ulcers. Fluorescein, however, gave them no distinct color. In the treatment, atropine and warm fomentations were applied; but the most marked benefit was produced by the salicylates, usually given in gram doses every 2 hours.

Two cases of keratitis of probably rheumatic origin are reported by Hansell. But neither of them correspond closely with Asmus' description of the type. In one the corneal infiltration seemed to ally it to the lattice-form opacity described below. This case was rapidly relieved by small doses of sodium salicylate and Fowler's solution. In the other case the dots of opacity were immediately behind

Bowman's membrane. This eye showed increased tension and was quickly relieved by the use of eserine.

CORNEAL OPACITIES

LATTICE-FORM OPACITY OF THE CORNEA has been suspected to be an hereditary condition, having been observed previously in father and daughter. This point is now settled by Freund's report of 15 cases occurring in two families, and running through at least four generations. The opacity appeared at or after puberty. The earliest trace of its beginning was in a boy aged 13. It reaches its full development between 30 and 40. Both eyes are always affected, but not to the same extent. The commencement is so gradual that it may be unnoticed, even by the patient, until accident or acute disease calls attention to the eyes. The opacity is thickest at the center of the cornea. The margin, for a width of one or two millimeters, remains relatively clear. In one case optical iridectomy was done to give a peripheral pupil. Examination of the opacity, at an early stage, shows that it is made up of little streaks and dots of light gray, which by transmitted light appear transparent, like threads of glass and little drops of water on a glass plate. The streaks form an irregular mesh-work, intersecting each other obliquely, forming the lattice figure which gives the condition its name. This arrangement is indicated in the accompanying figure.

As the process advances the density of the opacity hides the lattice appearance near the center Fig. 15. But the little points of deposit can still be seen with a lens; and towards the corneal margin the interlacing lines may also be recognized. Both the superficial and deeper layers of the cornea are involved, and beginning at the center of the cornea the surface becomes roughened, appearing as if strewn with fine sand. The dots become white and chalky in appearance.

In some cases the process becomes arrested and remains

stationary throughout life—the eyes being blind, but giving little trouble. In others a very annoying irritation or inflammation is set up. The degenerated epithelium is lost and the grains of chalky deposit come to the surface. Or corneal ulcers form, with their usual symptoms. The scars

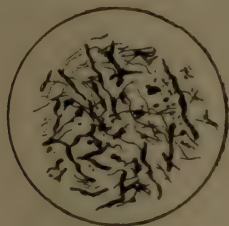


Fig. 14.

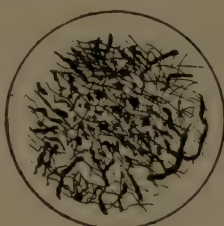


Fig. 15.

Hereditary Lattice-like Opacity of the Cornea.

caused by these ulcers may veil the original opacity. No evidence of causation by syphilis or other constitutional disease was found. Most of the patients were healthy, even robust. No treatment except iridectomy is mentioned as of value.

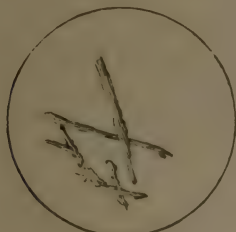


Fig. 16.

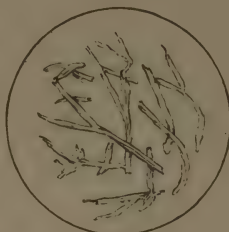


Fig. 17.

Traumatic Lattice-like Opacity of the Cornea.

Lattice-form opacity with corneal injuries is described by Caspar. The opacities appear in the first few days after the injury; and usually disappear entirely within a month or two, although one case that he reports showed a distinct opacity at the end of 6 months. The gray streaks or lines are much larger and less numerous than those seen in the

hereditary form of opacity above described. They are situated beneath the epithelium, although in one place, opposite a swelling on one of the streaks, there was disturbance of the corneal epithelium, and coloring by fluorescein. Different stages in the development of such an opacity are shown in the accompanying figures.

Caspar reports three cases; one of injury by molten metal; another, a perforating wound of the limbus by a splinter of iron; and the third, a wound of the cornea without perforation. In all cases there was complete clearing up of the

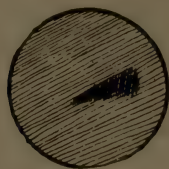


Fig. 18.



Fig. 19.

Kalt's Case of Band-like Opacity of Cornea.

cornea; and healing of the wound, although in two cases vision was permanently impaired by injury to deeper parts of the eye.

PRIMARY BAND-LIKE OPACITY.—Band-like opacity of the cornea occurring in degenerated eye-balls has frequently been studied microscopically. But this form of opacity arising in eyes otherwise healthy has not been so fully investigated; although it is of much the greater practical importance. Kalt reports a case occurring in a patient 73 years of age, from whose eye he removed the opacity with a Graefe knife, shaving off with it the superficial layers of the cornea; and studied the specimen microscopically and chemically. The opacity was brownish gray, and distributed as shown in the accompanying figures. It had come on 5 years before, without other ocular disease and prevented reading with the left eye, Fig 19, although otherwise in good condition. Vision with this eye was reduced to $1/8$. The right eye had lost the crystalline lens through traumatic cataract

many years before. With a +11.D. lens it had vision of 1/3. Examination of the urine showed daily elimination of a very large quantity of phosphates.

The removal of the superficial layers of the cornea showed that the deeper portion was quite transparent. In microscopic sections it was found that the layers of true corneal tissue removed with the opacity were also normal. In the epithelial layer the number of basal cells was diminished, but otherwise it was little altered. The striking abnormality was the invasion of Bowman's membrane, and the adjoining part of the epithelial cells, by a granular opaque deposit. By chemical reactions this deposit was identified as calcium phosphate.

The location of the band in the portion of the cornea habitually exposed by the opening of the lids, is explained by Kalt as due to pressure of the lids on the other portions of the cornea. It seems quite as reasonable to suppose that this distribution is due to evaporation from the exposed surface, with the turning towards that portion, of the corneal lymph currents. The freedom of the corneal margin from the opacity is an equally striking characteristic of all these cases. It has also been noted above with regard to the lattice-form opacities, and to a large extent is true of other non-vascular opacities and alterations. Better nutrition of the peripheral portions of the cornea on account of nearness to the blood-vessel supply, may account for it.

CALCAREOUS DEGENERATION OF CORNEAL SCARS.—The deposit of lime salts and atrophy of tissue elements in a corneal scar may proceed to such an extent, that it will come to act as a foreign body. Two cases of the kind are reported by Moulton, in each of which the irritation caused by the chalky plate, which had formed in an adherent leucoma, required its excision. The leucoma had existed in one case for 35 and in the other for 23 years; and only comparatively recently had either caused any trouble. The removal of the calcareous mass was followed by prompt, normal healing, and complete relief.

SOLUTION OF CALCAREOUS OPACITIES.—To promote the solution and removal of calcareous deposits in the cornea, Mazet has used instillations of a solution of lithium benzoate. He reports two cases in which white, chalky-looking deposits gradually disappeared under this treatment. In one case the deposits followed ptyctenular ophthalmia; in the other they succeeded the corneal complications of trachoma. Both cases had previously been treated with yellow oxid of mercury ointment and other applications, without material benefit.

The lithium benzoate was used in 2.5 to 10 per cent solutions, in distilled water. They were instilled freely two or three times a day. They were not irritant; but Mazet commenced with the weaker solution and gradually increased its strength. This treatment would be indicated in all cases showing deposits of calcium phosphate or carbonate.

TREATMENT OF VASCULAR OPACITIES.—Opacities of the cornea are results of some inflammatory or degenerative process. The first point in their treatment is to attend to the cause. After that has been removed, special means to reduce the opacity are in order. Losing sight of the importance of removing the cause has brought discredit to many valuable methods of treatment—among others, to peritomy for vascular opacities. When the vascularization of the cornea has accomplished its useful purpose, and the vessels tend to persist, this operation may be very beneficial.

Fox has urged its value and suggests as an improvement a modification which he calls *peridectomy*. It consists in excising a strip of bulbar conjunctiva 2 to 5 mm. wide, immediately surrounding the cornea. The vessels on the cornea are then scarified at the limbus. He finds this operation of value, also, in some cases of iritis and kerato-iritis, particularly when complicated by vascularization of the cornea. He reports 108 operations of this character performed within three years. Snell also has performed peritomy in about 100 cases, and considers it of especial value; and Elliot calls attention to the service it can render in pannus due to trachoma.

DISCOLORATION OF THE CORNEA.—A case of *congenital melanosis* of the cornea is reported by zur Nedden. In the deeper layers of the cornea, particularly in its lower portion, he found small, black pigment deposits. The marginal zone (which I have commented on above) was free from them. In the anterior chamber he also found a net-work of pigmented tissue. He found the record of but one similar case previously reported. That the condition was congenital he assumes on account of the similarity of the deposits in both eyes, and the absence of any history of severe ocular inflammation.

Two cases of *greenish discoloration* of the cornea are reported by Fleischer. In these cases the discoloration affected only the peripheral portion of the cornea to the width of about 1 mm. It was due to the presence of brownish green spots and flecks in the deepest layers. One of the patients suffered from multiple sclerosis, the other from pseudo-sclerosis. The only other case of the kind that Fleischer has been able to discover was reported by Kayser (*Klinische Monatsblätter für Augenheilkunde*, July, 1902), whose patient also suffered from multiple sclerosis.

A case of *staining* of the cornea by *blood pigment* following traumatic hemorrhage into the anterior chamber, is reported by Ball. In this case the entire cornea was of a brick-dust color, although sometimes this form of staining and opacity leaves the periphery of the cornea clear.

Grauer reports a case of actual *hemorrhage into the substance of the cornea*. It occurred in a man aged 50, convalescent from diphtheria, with very tortuous temporal arteries; and who died a year and a half later of cerebral hemorrhage. The spot lay in the lower, outer quadrant, extending up to the margin of the pupil, was almost black in color, and surrounded by a whitish zone. It remained unchanged until the patient's death.

Staining of the cornea by copper sulphate through its prolonged use in the treatment of trachoma is fully described by Stephenson. It has been observed exclusively in children

who have long been under treatment; and the longer the treatment, the more pronounced the opacity. Scrapings from the cornea give the chemical reactions of copper; which is probably deposited as an oxid, or possibly an albuminate. The deposit begins in a crescent above and below, situated like the arcus senilis. In the most advanced stages it comes to occupy the whole cornea except a peripheral ring not more than 1 mm. in width. The color of the opacity is reddish brown, rusty or greenish. It is situated in the superficial layers and, except in the most advanced cases, interferes but little with sight. In 147 children of from 4 to 16 years of age, that had been under treatment with copper sulphate for trachoma, these opacities were found in 90. The intensity of the opacity was directly proportionate to the number of applications that had been made to the eye.

CORNEAL TATTOOING.—As bearing on the *safety* of tattooing, Mishina has investigated the presence of micro-organisms in India inks. With powdered ink his cultures gave negative results; with ink rubbed up under disinfected tissue (protected from the air) the results were also negative; but with ink rubbed up with the sterile water, but exposed to the air, several forms of microbes developed. He concludes that inks of either the better or cheaper sorts are sterile; but that they are liable to be contaminated in rubbing them up for use.

Methods.—De Wecker, discussing the bad results of tattooing that have been published, says they have all occurred in cases of adherent leucoma, cases which he has always regarded as dangerous. He has the ink rubbed up in a 1:2000 sublimate solution, and places it in a hot-air sterilizer before using. In performing the operation he holds the lids apart and steadies the eye-ball with a thumb and finger of the left hand; and uses a broad needle to introduce the ink into the corneal tissue. In doing the operation for optical purposes he holds that it is absolutely necessary that a speculum be not used. He says of tattooing: "We are yet in the infancy of that art."

Borsch employs the eye-speculum and the fixation forceps. He rubs up the ink with a 1:5000 sublimate solution until it is a little thicker than ordinary black ink. The circular black pupil is first made, starting with a center thrust for a guide, followed by a number of thrusts marking the boundary of the circle. The black pupil may be made at one sitting. Next the iris is to be outlined. A circle representing the limbus is first marked out. Then the iris striations are made by oblique needle thrusts radiating from the pupil.

To secure a perfectly *circular pupil* Armaignac has used the shield guide, shown in the accompanying illustration (Fig. 20). This is applied to the anesthetized cornea, with

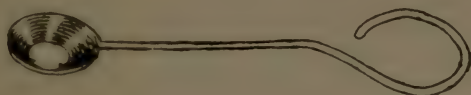


Fig. 20.—Armaignac's Guide Shield for Tattooing the Cornea.

the opening opposite the desired position of the pupil. The three points at the edge of the opening serve to keep it fixed upon the eye-ball. The needle-thrusts are made into the opening and cannot be made into other parts of the cornea. The size of the opening may be 4 or 5 mm., according to the pupil desired. He has also had a larger opening of 11 mm. made, to serve as a guide for the outline of the iris periphery.

Holth calls attention to the method recommended by Czermak in his book on ophthalmic operations, of using a corneal trephine to mark the outline of the pupil. This method he has used, and also a large circle of 10.5, 11 or 11.5 mm. in diameter to outline the periphery of the iris. Holth, after using the corneal trephine, raises the epithelium in the circumference of the circle thus formed, with a sharp curette, and pricks the surface within the circle with a cataract needle, without dipping it in the ink. After all hemorrhage is arrested, the ink is introduced upon tattooing needles, 4 needles bound together, which furnish in the space between them a conduit for the ink.

TREATMENT OF CONICAL CORNEA.—As Bradfield puts it, this should begin by correcting errors in the general health. Next comes rest of the eyes; and third, correction of errors of refraction. After these come methods of local treatment to influence the corneal curvature. Burnham has found great benefit from the hypodermic use of *pilocarpine*, especially when associated with mercury and potassium iodide internally. He reports a case in which vision was reduced to 9/200, but rose under treatment in 8 months to 20/200. Suspension of the treatment, and use of the eyes in sight-seeing, caused the vision to become worse. Treatment was resumed and vision improved to 20/100. He has employed this line of treatment for 12 years; and finds the results "sometimes brilliant and withal permanent." He believes that its favorable effects are felt in all parts of the eye.

In using the *galvano-cautery* for conical cornea, to avoid a dense scar and the necessity for an optical iridectomy, Dodd makes a series of dots with the cautery, about 1 mm. apart, and arranged in the form of a horse-shoe about the apex of the cone; leaving the side toward the center of the pupil uncauterized. The operation can be repeated if necessary.

Morton reports 13 cases in which he operated on 20 eyes, doing *excision of the apex* of the cone 26 times, and using the cautery 4 times. Because of no improvement from the first attempt, the operation of excision was repeated 8 times, and in 4 of these cases the second operation produced improvement. Among secondary operations iridectomy was done 9 times. Five times on account of increased tension; and for optical reasons in 4. Division of anterior synechia was practiced twice, and in two cases paracentesis was done. The cautery was used without perforation once, and with perforation in three cases.

In 17 of the 20 eyes vision was improved after operation; and this improvement was observed after intervals of 6 months to 20 years. In one of Morton's cases, shown before the British Ophthalmological Society, vision of 6/9 with glasses was maintained in one eye 19 years and in the other

20 years after the operation. It is very remarkable, however, that of these 20 eyes it is reported that 14 could not be improved by glasses before operation. I cannot recall ever having seen a case of conical cornea in which better vision could not be obtained through some kind of a correcting lens.

In discussing Morton's paper Grossman reported that he had operated upon 12 cases with the cautery, always taking care not to perforate the anterior chamber. With the exception of a single eye a satisfactory result had always been attained.

TRANSPLANTATION OF THE CORNEA.—The hope that by this operation a transparent cornea might be secured seems very far from realization. The best results yet attained through it are those reported by Proeller. In 15 cases he had but two failures. But the greatest improvement of vision he obtained only permitted the counting of fingers at 2 meters. True, in another case the eye was able to count fingers at 5 meters after the operation; but that was the vision which it had before operation, the transplantation being done for keratocele.

In 9 cases of complete, or almost complete, anterior staphyloma, transplantation produced a permanent flattening of the cornea in 5. Of the two eyes in which the result was bad, one was eviscerated and the other enucleated. But both were cases of total staphyloma which would probably have required such treatment if transplantation had not been attempted. Transplantation is scarcely to be thought of as a method of improving vision, but it may in some cases improve the condition of the sightless globe, and do away with the necessity for enucleation or one of its substitutes.

Diseases of the Sclera

SCLERITIS.—Alt and Steffens have each reported studies of the pathologic anatomy of scleritis. The latter reports minutely his findings in a single case. These are little more than the ordinary changes of chronic inflammation in the sclera, cornea, uveal tract and vitreous—especially round cell infiltrations. Alt studied together episcleritis and scleritis; and his microscopic sections showed chiefly more superficial lesions. He has usually been unable to find evidence of the rheumatic, gouty, or other diathesis to which these diseases are commonly ascribed; although in some cases the anti-diathetic treatment has seemed of benefit. He has tried with little success many of the methods of treatment usually advised; but he has had a number of excellent results from the local application of calomel. But in other cases the effect of the calomel treatment has been negative or even decidedly bad.

The Pupil

NERVE TRACTS INFLUENCING THE PUPIL.—There is still so much uncertainty with regard to the paths of nerve impulses that affect the size of the pupil that it is not worth while to reproduce here the elaborate scheme now marked out by Bach and Meyer—a modification of that which Bach had previously published. It is sufficient to mention that experiments upon cats lead them to place the principal center for the pupillary reflex at the spinal end of the fourth ventricle. This center they regard as inhibitory, and locate another center at least as high as the corpora quadrigemina. On the other hand, Marina, believing that he has demonstrated the iris movements to be independent of the third nerve nucleus, urges that the most important center for the

light reflex of the pupil lies in the ciliary ganglion; although he does not deny the existence of other centers.

Until we know more of the physiology of the pupillary movements, their significance must be judged from the side of clinical experience. This will increase in value as we use a complete *routine method of examining the pupil*. Coppez suggests the following scheme of observing the condition of the pupils:

(1) Note the relative size of the pupils. (2) Cover one eye with a black shade; wait one or two minutes for the pupil of the other eye to reach equilibrium, and then measure its exact diameter. Do the same with the other eye. (3) Test the direct reaction by keeping the other eye covered and alternately covering and exposing the eye under observation. Do this for each eye. (4) Place a hand over each eye and alternately remove and cover, first one and then the other. (5) Test the reaction to convergence by having the patient fix an object 30 cm. in front of the eyes.

The above tests are to be made with the patient facing a window supplying strong diffused daylight. Then some or all of them may be repeated with diminished light. Bach prefers artificial light in a darkened room, because it is more constant, always available, more manageable and causes less corneal reflex. Next a cocain solution may be instilled, and the increased dilation thus obtained noted. Finally, a drop of atropin solution 1:200 may be used. For the latter procedure homatropin might be substituted with diminished inconvenience to the patient.

ARGYLL-ROBERTSON PUPIL.—The absence of the light reflex, with retention of other pupillary reflexes, is the most definite and significant evidence the pupil gives with reference to general disease. But the nature and location of the lesion which produces this symptom is still quite uncertain. The latest study of it by Thomas merely brings together conflicting observations and deductions regarding the nerve tracts involved. Clarke has attempted to determine the relation of the Argyll-Robertson symptom to syphilis. In 37

cases of syphilis, 28 of which were cerebral, the pupils reacted well to light and accommodation in 25; and in none was the complete Argyll-Robertson phenomenon present. On the other hand, among 40 cases of tabes, 31 showed the Argyll-Robertson symptom. It was present in 6 patients in both eyes, and in one unilaterally, who positively denied syphilis. Clarke believes the symptom is para-syphilitic; though there is possibly also some other unknown cause.

PARADOXICAL PUPIL REACTION.—The dilation of the pupil on exposure to strong light has been frequently observed. But the reversal of its ordinary behavior with reference to accommodation or convergence has been very rarely noted. Spiller reports three cases in which the pupil contracted on looking to a distance, and dilated on looking at a near object. He offers no theory to account for its occurrence.

Diseases of the Uveal Tract

RHEUMATIC IRITIS is rare, altho rheumatism is usually placed after syphilis as the next most frequent cause of iritis. Yeld, who analyzed 159 cases of primary iritis, found that in no single instance was the evidence of true rheumatism conclusive. He also found among 250 cases of rheumatic fever, and 100 cases of chorea, no case in which iritis had occurred. Nevertheless, he found the association of iritis with joint affections very common; and he ascribes them to common causes, especially gonorrhea and septic conditions. The joint conditions associated with iritis are usually fixed, not fugitive like those of acute rheumatism. But iritis does occur with acute rheumatism. Forster reports a case, and I can recall seeing one very striking case of the kind.

Paine and Poynton isolated a diplococcus, which they looked upon as the *specific cause* of rheumatic fever. Experimenting with this in rabbits, they found it always pro-

duced arthritis and, in exceptional instances (2 cases out of 14), an irido-cyclitis which they look upon as a true rheumatic irido-cyclitis. In both these cases the anterior chamber teemed with diplococci, as they had found them in rheumatic lesions of different parts of the body. Poynton calls attention to the fact that this diplococcus, like the gonococcus, can continue to exist in the system for a long time; and he warns against the too ready acceptance of gonococcic infection as the explanation of iritis unless that organism can be demonstrated.

IRITIC EXUDATES.—When, in iritis, an excessive amount of plastic exudate appears in the anterior chamber, the recovery and subsequent usefulness of the eye depend largely upon the early removal of this material. If this could not otherwise be effected, it would be proper to tap the anterior chamber, and if necessary reopen it day after day, as we sometimes do for hypopion. But, of course, if the same thing can be accomplished through the natural channels of elimination, that is to be preferred.

Young reports a case of uveitis in which within the first week there formed in the anterior chamber a membrane-like mass of dirty white color, which covered the whole pupil, and extended by a web-like band to the periphery of the anterior chamber. Under sodium salicylate, 100 grains per day, this was almost entirely absorbed during the second week of the disease, and soon after had disappeared altogether. Pain had been relieved by this treatment before the exudate had begun to diminish. Morton would give still larger doses; 40 grains every two or three hours until pain is relieved, or he would start with an initial dose of 60 grains.

The final results of such large amounts of exudate, remaining for a long time in the anterior chamber, are illustrated by a case reported by Rumschewitsch. The eye had been injured by a sword stroke, and the inflammation continued four months. When, years later, it was enucleated a thick membrane covered the anterior surface of the iris,

and the periphery of the anterior chamber was quite obliterated.

Division of Adhesions.—The fact that posterior synechias occasionally disappear entirely by absorption, after they have resisted the prolonged action of atropin, added to the fact that they sometimes remain indefinitely without causing serious symptoms, has led to the neglect of operative interference with them. There can be no doubt that many eyes would be left in permanently better condition by the careful division of their iritic adhesions. One obstacle to the accomplishment of this has been the lack of an instrument perfectly adapted to their division. A blunt-pointed hook for this purpose has been devised by Fulton, who believes that operative treatment should be resorted to when it is found that adhesions of the iris to the lens resist the action of mydriatics. Separation with the hook he considers much safer than the pulling loose of the adhesions with iris forceps.

PLASTIC CHOROIDITIS.—Plastic chorioretinitis, Duane calls the condition seen in 8 cases which he reports. He found the retina seriously involved in most or all of them. His cases were marked by pretty sharply defined, whitish aggregations of connective tissue, some of which stretched along the retina, or projected into the vitreous (retinitis proliferans). Once developed, the plastic products are apt to remain unchanged for years, although the slighter formations may be capable of absorption. Mercury and iodides seem to constitute the best form of treatment.

Six cases of *circumscribed choroiditis* believed to be not malignant are reported by Cutler. The macula was not involved. The cases were not syphilitic; but the disease seemed to depend on constitutional conditions, more or less temporary. One had a history of tuberculosis, and a recent sore throat and lumbar pain. The second suffered from intestinal toxemia. The third developed pleurisy and septic fever shortly after the choroiditis. In the 4th case there was episcleritis in the other eye, sore throat, and pain in the

knee, suggesting rheumatism. The 5th case began during typhoid fever, and the 6th gave no clue to causation. Undoubtedly the list of constitutional conditions causing uveitis must be extended. But all the new light that we can get upon the subject renders more evident the fact that uveitis generally depends on some constitutional derangement. Cutler protests against the routine use of heroic treatment by pilocarpin injections or salicylates for cases such as he reports.

PANOPHTHALMITIS.—This is liable to be set up by quite varied micro-organisms. Liebrecht reports a case due to streptococcus infection following wound of the side; and one occurring in fatal pyemia in which staphylococcus was the pathogenic organism. The common saprophyte, bacillus subtilis, is credited by Silberschmidt with causing it. Axenfeld illustrates the growth of this bacillus from a preparation from the crystalline lens, in a case of traumatic cataract. Weeks reports a case due to the micrococcus lanceolatus; and Gilfillan one arising in the course of typhoid fever.

Weeks' case occurred without any perforating wound of the eye-ball, but there was some history of a blow on the eye-ball 5 or 6 days previously. In Gilfillan's case the eye affected was already blind from previous injury. Its fellow, previously healthy, was not affected. These facts seem to take special significance from the results of experiments reported by Selenskowsky and Woizechowsky.

Using the eyes of rabbits and cats, they found that it was possible to induce the entrance into the vitreous, of bacteria circulating in the blood, direct from the blood vessels of the posterior portion of the eye. With a severe general infection, these bacteria passed into the vitreous of normal non-irritated eyes. With a mild or moderately severe infection the bacteria entered the vitreous only when the eye had been injured shortly before. And an injury to both anterior and posterior portions was most favorable for the entrance of the bacteria. An injury to the posterior portion alone came next; while injury to the anterior portion only was favor-

able in far less degree. Stock, by injecting virulent tubercle bacilli into the general circulation of dogs, produced lesions of all parts of the eye-ball, including even incipient cataract.

UVEAL TUBERCULOSIS.—In all Stock's experiments one or more parts of the uveal tract became the seat of a tubercular invasion, the anterior portions being the more disposed to suffer tubercular lesions.

In *tubercular iritis*, Wilder points out that the multiple lesions appear generally in the periphery of the iris, and tend to leave small atrophied patches. He thinks the giant-cell of tubercle may be known from other giant-cells by its rounded form and the peripheral situation of its nuclei. Jessop, reporting two cases of tubercular choroiditis, calls attention to the absence of pigment about the choroidal deposits, as compared with other choroidal lesions; and also to the absence of vitreous opacities and new vessels.

Loeb was able, by recognition of choroidal tubercles, to make the diagnosis between *miliary tuberculosis* and *typhoid fever*. He points out that, for this purpose, tubercle of the choroid is a symptom of great importance. In about half of the cases of general miliary tuberculosis, tubercle of the choroid may be found. It should be looked for in all cases of supposed typhoid fever, running an atypical course, especially when the Widal reaction is absent.

The lesions are generally found in the posterior portion of the choroid, where they cause whitish discoloration of the fundus, proportionate to the size of the tubercle. The shading from this spot into the normal red of the fundus is quite gradual; and there is very rarely any pigment ring. These tubercles may grow rapidly. The spots they cause may become even larger than the optic disk. The search for them should be frequently repeated, since they may become clearly visible in a single day. See retinal actinomyces.

Single tubercular growths of the uveal tract are generally difficult to differentiate from other intraocular tumors. Arnold Knapp reports a case in which the tumor was located in the head of the optic nerve. Zur Nedden reports 2 cases,

one of which is shown in fig. 21, in which the growth seemed to start in the choroid and involve and break through the sclera. In one of Jessop's cases such a scleral growth appearing anteriorly was removed, and complete healing followed.

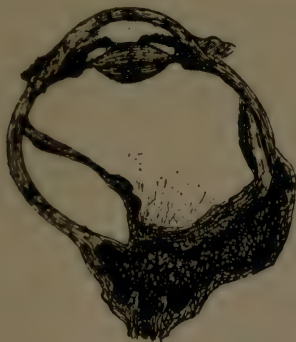


Fig. 21.—Zur Nedden's Case of Choroidal Tuberculosis.

In the *treatment of uveal tuberculosis* the general treatment for tuberculosis is of the highest importance. In Jessop's case, just referred to, vision had been reduced to perception of moving objects. But with 18 months of open air treatment it had improved to 6/18 partly, with corresponding changes in the ophthalmoscopic appearances. In Jessop's other case, under observation for 3 1/2 years, the choroidal mass completely disappeared, leaving vision 6/5.

Enucleation of the eye-ball, which Knapp and zur Nedden resorted to, may be the only thing to be advised where the diagnosis of the nature of the growth is impossible. But apart from such a situation it is hardly indicated. With uveal tuberculosis there commonly exists tuberculosis elsewhere. It is by no means proven that the uveal disease is ever primary; and (outside the pathologic laboratory) results like those of Jessop are greatly preferable to enucleation.

For tubercular iritis, in the way of local treatment, Weill observed decided benefit from the placing of iodoform in

the anterior chamber, in a case of chronic iritis with reduction of vision to perception of the direction of shadows. The eyes became free from inflammation, the corneas cleared perceptibly, and vision in each eye rose to counting fingers at seven feet.

UVEAL GUMMA.—The anatomic examination of a case of gumma of the iris is reported by Rumschewitsch. The growth appeared some 10 years after infection. The eye had been greatly damaged by iritis during the secondary stage. There was general posterior synechia, and adhesion of the iris periphery to the cornea. The structure of the growth was that of a typical gumma. The central portion had undergone caseation. Many of the blood vessels were obliterated; and the large cells were arranged concentrically around the altered vessels. This was a very clear case of gumma. But Rumschewitsch is not inclined to reject the cases previously reported, which occurred during the secondary stage; and he takes issue with Coppez for doing so.

Parsons reports 2 cases of gumma of the ciliary body examined microscopically, one of which occurred only three months after primary infection. Its structure was that of a granuloma rather than a gumma. Of the other Parsons says: "The main mass is made up of badly staining leucocytes, which have run together into an albuminous mass, in which faint remnants of nuclei, red blood corpuscles, shreds of fibrous tissue and pigment granules can be seen. There are no giant-cells, and there is no effort toward repair." He admits that continental authors would class his first case as a condyloma, and perhaps the second also. But he considers that "quite immaterial," as he holds to the microscopic identity of the two groups. As regards these syphilitic formations arising from the uveal tract; while the extremes may differ sufficiently to justify recognition as separate types, the series extending from the typical granuloma to the typical gumma is an unbroken one; and for most purposes they may all be classed together.

OSSIFICATION OF THE CHOROID.—Snowball reported seven cases, from the anatomic study of which he concluded; that in the choroid, bone is never developed through cartilage, but is always of the periosteal type. The osteoblasts arise from the embryonic cells. They are stimulated into growth by long-standing irritation, so that they form first fibrous tissue, and then bone. In nearly all cases the bone is developed in the posterior portion of the choroid around the optic nerve. Probably this occurs because of a richer supply of nutritive fluids, on account of the nearness of the short ciliary arteries.

In Snowball's cases the average time, from the disorganization of the eye until the removal, had been 15 years. In a case reported by Allport, some 30 years had elapsed since the injury of the eye. Ossification had involved both the choroid and vitreous, giving rise to a mass of bone "about the size and shape of a molar tooth." The early period at which bone formations may begin is illustrated by Buchanan's case. A boy of 17 suffered from a perforating wound which suppurated. The shrunken globe was removed ten weeks after the injury; and was found to contain a mass of fibrous tissue, in which was a nodule of true bone.

LOCALIZATION OF CHOROIDAL AND RETINAL DISEASE.—The influence of the ciliary arteries on bone formation has been alluded to above. Nettleship has undertaken to show the effect of the distribution of the choroidal arteries, as a factor in the localization of certain forms of choroiditis and retinitis. The groups that he especially considers are (A) those of central, usually senile, chorio-retinitis, not associated with any particular constitutional state; and (B) retinitis pigmentosa and syphilitic retinitis with ring scotoma. In group A he includes central guttate choroiditis (Tay's choroiditis), epithelial atrophy at the macula and surrounding parts, deeper atrophy of the same region, and grayish or yellowish white deposits beneath the retina, forming an oval or rounded opaque patch in the region of the macula. Nettleship has also seen many mixed forms, lying between these

and typical circinate retinitis. In this group may be included the type of degeneration which I have reported, involving the central zone of choroid and retina, occurring in sisters. The changes are illustrated in the colored plate (see frontispiece). They affected both eyes, almost equally.

Nettleship suggests, that these different forms of degenerative change may have their starting point in disturbance of the blood supply of the part; perhaps from disease of the walls of the choroidal vessels or of the posterior ciliary arteries which supply them.

In regard to his group B, Nettleship points out that in retinitis pigmentosa the ophthalmoscopic changes are most conspicuous in, or are confined to an equatorial belt. (See also observations of Gonin and Henderson, p. 126.) The structures in front of this as well as those behind it show less alteration. This is even more striking when one examines the opened eye-ball. To explain this distribution of the lesions there is nothing in the structure of the choroid or retina, but Nettleship points out that the equatorial region is a sort of "divide" between the vascular systems. The choroidal vessels on the one side are supplied by the short ciliary, and on the other by the anterior and long ciliary arteries. In many of the anastomosing twigs the current is liable to be slowed or reversed; so that the region is not very efficiently served by either vascular system.

ATROPHY OF THE IRIS.—Harms reports an interesting case of spontaneous, gradual atrophy of the iris, leading to the formation of extensive gaps in that membrane, polycoria. There was no history of injury or previous disease, and the patient had noticed the slowly progressive changes in the appearance of his left eye some ten years before. Its vision was 5/10. He presented the condition shown in the accompanying figure. His right eye was normal.

Harms has collected from the literature such cases as most nearly resemble this one. Atrophy of the iris and consequent polycoria is not very rare after injury or disease of the eye, especially with anterior synechia. I have discovered it

two or three times shortly after cataract extraction, when I could not feel sure that it had not been present before the operation, being overlooked on account of the conditions unfavorable for its discovery, with the cataract behind the iris.

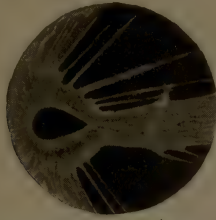


Fig. 22.—Harms' Case of Atrophy of the Iris.

Harms calls attention to the absence of any mechanical stress or traction upon the iris in his case. The normal sphincter, however, is constantly exerting a variable amount of traction; and if dragging of the iris is a factor in the cases that follow traumatism, we have in the physiologic tension what may be the mechanical equivalent.

Diseases of the Retina

INFLUENCE OF FATIGUE IN CAUSING ORGANIC DISEASE.
—Nettleship has gradually come to attribute greater influence to fatigue and overwork, local and general, than to more directly mechanical agencies in the production of organic disease of the retina and choroid, especially intraocular hemorrhage, and even detachment of the retina. He has brought together a series of 9 cases in which the share of fatigue is quite striking, especially in the way of causing recurrent attacks, or involvement of the second eye, after a repetition of the excessive fatigue. He alludes to fatigue of the eye muscles, the effects of evaporation, exposure, and friction of the eye lids in producing asthenopia. But he directs attention particularly to the choroid and retina.

In one case both eyes had been damaged by looking at an eclipse. One was kept covered until it recovered full vision; altho it still showed some ill-defined choroidal dots in the macula. The other continued in use; and never entirely recovered, despite the fact that it showed no lesions at the macula or elsewhere. Another was a case of hemorrhage and other exudate into the retina, following very hard use by artificial light, undertaken for a wager. Myopic and senile eyes seem especially liable to suffer from fatigue. Nettleship mentions particularly, active, excitable, plethoric women with high myopia, between the ages of 40 and 50. Influenza or other temporarily depressing condition would appear from these cases to render the eye distinctly more susceptible to the effects of overuse.

VASCULAR DILATATION WITH HEART DISEASE.—*Retinal aneurism* is rare. Fisher reports a case in which a series of aneurismal dilatations gave two of the retinal arteries a beaded appearance. The patient, a boy aged 13, had rheumatic fever when 5 years old; and at 7 had cardiac disease with dilatation. The retinal changes included a large white plaque, and small hemorrhages. Additional dilatations appeared while the patient was under observation.

In the case of congenital heart disease, in a boy 9 years old, Hammill reports that the ophthalmoscopic examination by Posey, showed both retinal arteries and veins greatly dilated and tortuous, resembling large angle worms. There were a few small hemorrhages near the nerve head, which was obscured by swollen retina.

OBSTRUCTION OF RETINAL VESSELS.—A case of *complete obstruction of the upper temporal artery*, with loss of the lower nasal field of vision, is reported by de Schweinitz. The patient was a girl of 15 suffering from simple anemia, who gave a history of being lightly struck on the eye with the end of a finger, about the time the indistinctness of vision appeared. She was seen at the end of two weeks. The obstructed artery appeared as a white cord, with a faint red line in the center. The veins were distended and dark.

There were two small flame-shaped hemorrhages near the yellowish white exudate that covered the point of obstruction. Impeded circulation in the veins, where they were crossed by arteries, was noticed. De Schweinitz thinks it fair to assume that there were alterations in the coats of the arteries; for which, however, no other cause than the anemia was found. The slight blow on the eye might have been an exciting cause.

Reimar, from a very thorough review of cases of so-called embolism of the central retinal artery or its branches, concludes that neither embolism nor thrombosis explains the clinical picture often observed in obstruction of the retinal vessels. On the other hand, the theory of *endarteritis proliferans* of the affected artery does meet the requirements of the case; and that disease is present whenever thickening of the walls of the arteries is visible with the ophthalmoscope.

Arterial Collapse.—An exceedingly interesting and valuable case of vascular obstruction is reported by Hoppe. A woman, aged 32, from fright, suffered palpitation and shortness of breath; and noticed a disturbance of vision in her right eye. When seen next day the upper nasal quadrant of the field of vision was lost; and the ophthalmoscope showed complete obstruction of the lower temporal artery. The portion of the vessel indicated in figure 23, on the disk and extending one-fourth of a disk diameter beyond its margin, appeared to be absolutely empty. The remainder of the vessel was filled with venous blood. Watching it for $1\frac{1}{2}$ hours, this blood column was seen to retreat from the disk at times and again to return toward it. When it retreated it became indented or broken up as in figure 24. When the column returned toward the disk the vessel again appeared to be full. These movements were increased by taking a deep breath.

That night the patient was delivered of a still-born child.

On the fifth day the color of the blood column in the obstructed artery was brighter red. On the sixth day it had the usual arterial color; and the previously narrowed portion

of the vessel had become of nearly full width (see fig. 25), and vision had improved. Subsequently there was aneurismal dilatation of the previously contracted portion of the vessel, fig. 26; but ultimately it remained slightly narrowed. Vision became normal.

Hoppe points out that this case cannot be explained as



Fig. 23.

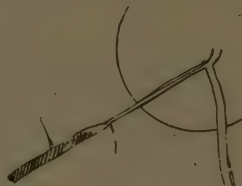


Fig. 24.

Hoppe's Case of Vascular Obstruction.

one of embolism, thrombosis or proliferating endarteritis. He suggests that the obstruction was due to the collapse of the arterial walls so that they came in contact, and there remained a sort of valvular closure for a time. He gives a figure illustrating this hypothetical condition, which resem-



Fig. 25.

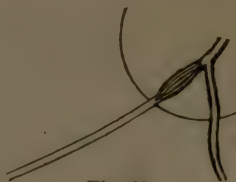


Fig. 26.

Hoppe's Case of Vascular Obstruction.

bles that of a hollow rubber ball, which may be bent in so that the two hemispheres are in contact, and will remain so indefinitely, being unable to regain its shape by its own elasticity. The collapse might occur in the first place by temporary lowering of the blood pressure, so that such pressure could be overcome by the intraocular tension. Hoppe's suggestion seems to agree better with the alternate withdrawal and return of the remaining blood column, and its general shape, than would the supposition of simple spasm of the arterial walls.

Whatever the true explanation, there can be no doubt that this case belongs to a class that is not very rare. It seems to me much more reasonable to suppose that cases of obstruction yielding to paracentesis, massage or the use of nitrite of amyl, or recovering spontaneously, have been of this character; rather than to assume that an embolus has become dislodged, or a thrombus removed.

In the daily watching of his case, Hoppe observed temporarily some minute vessels (see fig. 25), invisible at earlier



Fig. 27.

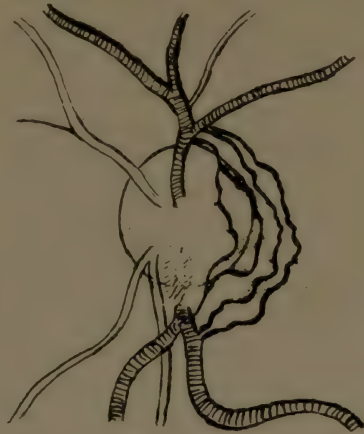


Fig. 28.

Hormuth's Cases I. and VII. of Anastomoses of Retinal Vessels.

and later periods. But it does not seem possible that they had any important influence in the restoration of circulation in the obstructed vessel. Hormuth, however, reports a series of seven cases of vascular obstruction, due to thrombosis and endophlebitis, in which more or less restoration of the circulation was brought about through the formation, or enlargement of anastomotic vessels. The accompanying figures show diagrammatically the positions of the obstructions, and the new formed vessels in two of his more striking cases.

LIPEMIA IN DIABETES.—A case in which the ophthalmoscopic examination showed the retinal arteries and veins to

be of the same light red, approaching the color of the fundus, is reported by Reis. The patient was in the last stage of diabetes, passing into coma and dying before complete examination could be made. The condition clearly depended not on the walls of the vessels, but upon an alteration of their contents. The blood contained an adventitious substance described as a fat. In a similar case reported by White, however, in which the blood in the retinal vessels appeared of a salmon or deep cream color, the substance found in the blood, although allied to the fats, was found not to be a true fat. White's patient improved under treatment for the diabetes, and the retinal vessels at length became normal in appearance.

RETINAL HEMORRHAGE.—Fleming has made a careful study of cases of *fracture of the base of the skull* with reference to the occurrence and diagnostic significance of retinal hemorrhages. He reports 11 cases of fracture of the base, with one of fracture of the squamous portion of the temporal bone. In five cases there was subarachnoid hemorrhage chiefly of one side; and retinal hemorrhage was present, confined to the eye of that side. In two cases the subarachnoid hemorrhage occurred on both sides, and there was retinal hemorrhage in both eyes. In five cases the subarachnoid effusion came on slowly and no retinal hemorrhage was found.

Recurring Hemorrhage.—Hemorrhage into the vitreous recurring more or less frequently is undoubtedly connected with *vascular disease*. Salomonsohn reports a case occurring in a man of 35, who had suffered from very frequent profuse epistaxis. Two branches of the superior temporal vein showed connections with vitreous opacities and new formed vessels. There were other evidences of vascular disease, and Salomonsohn designates the case as one of periphlebitis.

Treatment of Retinal Hemorrhage.—One case of extensive macular hemorrhage, with numerous smaller ones, treated by the Faradic current is reported by Derby. The patient was 73 years old. The treatment was continued for

7 months, the current being used three times a week for ten minute applications. Along with this, small doses of potassium iodide were given internally. Vision became quite as good as it had been before the occurrence of the hemorrhages.

Of course retinal hemorrhages usually clear up in time and if no new ones occur the eye may become normal. Subhyaloid hemorrhage in the region of the macula is very likely to clear away, leaving nearly or quite normal vision. And the continuous use of small doses of potassium iodide is one of the very best measures we have of lessening the liability to retinal hemorrhage in elderly persons. Derby hopes, however, that others will try this method of treatment so that its actual value may be conclusively determined.

HEMORRHAGIC RETINITIS.—It is quite impossible to draw any sharp line of classification, between vascular disease and inflammation of the retina. Ahlstrom reports as hemorrhagic retinitis a case which ended in glaucoma; but in which the lesion, which preceded the retinitis and *glaucoma*, was vascular. The walls of the vessels showed thickening and hyaline degeneration, especially those of the renal capillaries.

Fridenberg reports a case of striate retinitis with detachment of the retina which began with retinal hemorrhage, occurring as so-called *vicarious menstruation*. The first hemorrhage occurred with the first menstruation. Four months later menstruation failed to occur at the regular time and fresh hemorrhage occurred. Seven months after the original attack menstruation became established and the ophthalmoscopic condition continued from that time unchanged.

Schilling reports two cases of the formation of *stripes in the retina*, along with disease of the vessels. He also collects from the literature a large number of cases, in which similar retinal stripes have occurred in connection with anomalies, and especially increased tortuosity of the retinal vessels.

Hemorrhagic retinitis occurring in a case of cancer of the

lungs and cerebellum is reported by Natanson as an instance of what Pick has called the *retinitis of cachexia*. In this case there were extreme anemia, and absence of albuminuria. Optic neuritis might have been expected in connection with the intracranial disease, but the disk was pale and sharply outlined.

RENAL RETINITIS.—This too is eminently a disease of the retinal vessels. Nettleship has made a study of it based upon the records of all the cases he has seen and noted, some 107 in number; and from them he draws some important deductions. Of 42 cases not associated with pregnancy, 25 died within the first year, and only 9 survived more than 2 years. Among 22 cases connected with pregnancy, he knew of only 5 deaths; and only one of these occurred within two years of the retinitis. Six other cases were known to have lived more than two years, one having been followed as long as 24 years.

The influence which *decapsulation of the kidney* might have upon the prognosis of retinitis connected with chronic Bright's disease has been investigated by Suker. He was able to collect 15 cases of the kind. Four died within three days after the operation; one case died of intercurrent disease; and the other cases were all dead of the kidney disease within the first year, except one which Suker rejects as lacking any sufficient evidence of having presented renal retinitis. Suker states that since reading his paper he has heard of 4 other cases, all of which died within a few months after the operation. In the majority of cases which survived the operation for a time, temporary improvement of vision was recorded. But the amount of improvement is not stated except in one case in which vision came up from 20/60 to 20/40.

Nettleship points out that renal retinitis connected with *pregnancy*, is more likely to occur in later pregnancies. Thus, among 19 cases in which the point was noted, the retinitis occurred in the fifth or subsequent pregnancy in 14. In 4 cases the retinitis occurred with the first pregnancy. In

two of them subsequent pregnancies were known to have occurred with no return of renal or eye symptoms.

Nettleship finds that apart from pregnancy, renal retinitis occurs twice as often among men as among women, almost the same proportion as is shown by chronic kidney disease. About two-thirds of the cases are encountered between the ages of 30 and 60. But Nettleship reports an interesting group of 10 cases in patients under the age of 21. He expressly states that 3 of these patients never had scarlet fever. Six of the cases terminated in early death; but one of the patients, first seen at the age of 8, with white disks, shrunken arteries, thick white lines on the veins, pigment disturbance, and some white spots at the macula, seemed to recover; and was in good health at the age of 25.

With regard to the "*exudative*" and "*inflammatory*" forms of retinitis, Nettleship says: "I agree with Dr. West that the more violent cases of retinitis are chiefly toxic; and the milder, more chronic ones, chiefly vascular in origin. But I think it is unnatural to draw sharp distinctions between '*exudative*' or '*inflammatory*' and the '*degenerative*' varieties, or to associate either form with any particular kind of chronic nephritis. If we watch cases from an early stage to the end, we shall find that both in interstitial and in chronic parenchymatous nephritis, the retinitis may be either intense or comparatively mild."

He finds: "The greater the early haze and edema, the larger is the amount of these intensely white, late, degenerative deposits. When they appear, the earlier soft-edged patches have often, to a large extent, cleared off; they last much longer than the soft-edged patches, but if the patient lives they certainly lessen and probably disappear in the course of many months, though not in a shorter time."

As to the *recurrence of attacks* of renal retinitis, Nettleship thinks recurrences are possible if the first attack has not been followed by too extensive atrophy. In the unilateral cases he has observed that the retinal lesion has consisted chiefly or entirely of hemorrhage, the arteries being much

diseased. But in one fairly typical case the second eye was not attacked until several months after the first. As questions especially needing investigation he mentions the possibility of renal retinitis in connection with acute disease affecting previously healthy kidneys; and the relation of juvenile cases to scarlet fever and congenital syphilis.

CENTRAL RETINITIS.—Five cases of retinitis sharply limited to the immediate neighborhood of the fovea, are reported by Gradle. Three of these cases were monocular, and each had sharply defined scotoma. One of them recovered and remained well; another recovered but subsequently relapsed. In two cases both eyes were affected, with permanent reduction of vision. In none of the cases did the choroid seem to be involved, and there was little disturbance of the retinal pigment.

ANGIOID STREAKS IN THE RETINA.—The recorded observations referring to this condition are summarized by Lister, who reports the microscopic examination of two cases, which he thinks throw some light on the pathology of this condition. He examined badly degenerated eye-balls, in each of which the retina contained branching streaks which had formed in its deeper layers. Each of these streaks contained a new-formed vessel, along which the pigment deposits and other exudates were arranged. He thinks that in general the angioid streaks in the retina may have this same character. After some chronic inflammatory change in the retina, vessels penetrate the inflamed tissue. The vessel walls become pigmented, or undergo calcareous change. This accounts for the color of the streaks and the glistening patches seen along them. He thinks that the hemorrhages sometimes seen in this affection may arise from these new-formed vessels.

CIRCINATE RETINITIS.—The disappearance of the ring of white spots, characteristic of this form of retinal degeneration, is reported by de Schweinitz. In one case all trace of them disappeared, so that there remained only slight pallor of the outer quadrant of the optic disk, and a small greenish

white exudate in the upper portion of the macular region, with some streaks of atrophy and delicate pigment markings. In another case the lesions partly disappeared, the ring being broken up, while under observation; and later it was reported to have cleared away entirely. In a third case no apparent change was observed in the eye ground. He believes that these cases in which the lesions disappear should be recognized as a variety of circinate retinitis; although he admits there is a class of cases in which the ophthalmoscopic appearances remained unchanged; and another in which the degeneration of the retina is slowly progressive. In regard to the treatment, he has some faith in iodids, especially sodium iodid; and mercuric chlorid seems useful. He would also try subconjunctival saline injections, and perhaps pilocarpin diaphoresis.

Strezminski reports two cases. One occurred in a woman of 63 with marked vascular disease, both ocular and general; and who died of apoplexy some 15 months later. The other patient was a man aged 31, suffering from leukemia, who died of pulmonary disease about 4 months later. De Schweinitz's patients were aged 77, 35, and 33. Of these younger patients the last was suffering from adiposis dolorosa; the other seemed free from organic disease. Lawson showed before the Ophthalmological Society of the United Kingdom, a boy aged 9, with a condition in one eye, which he believed analagous to retinitis circinata.

Evidently there is a disposition to apply the term retinitis circinata rather widely, and so rob it of exact significance. While we cannot rule out cases like those of de Schweinitz, which are typical except that they partly recover, with disappearance of the most striking lesions, it does seem worth while to preserve the term to designate the clinical entity to which Fuchs originally called attention.

RETINITIS PIGMENTOSA.—A striking example of the *hereditary character* of this disease is reported by Snell. He traced a family history, including 67 descendants, of whom 28 had night-blindness and other evidences of pigmentary

degeneration of the retina. Among those affected, 15 were known to be females, and 10 males. The disease was followed through 5 generations, no generation being skipped. It was transmitted through both male and female lines. There was no evidence of consanguinity in marriage. The night-blindness in all cases showed itself in early childhood, when the children began to walk; and blindness was practically complete at the age of 40.

Aubineau reports a family in which one brother and two sisters were affected, two other brothers having escaped. In these patients also the night blindness was manifest in early childhood. The brother never had been able to go about alone. The parents were second cousins. Aubineau has also reported the cases of two brothers whose parents were first cousins.

ANATOMICAL CHANGES.—He reports anatomical examination of one of his cases. The striking points were the integrity of the nerve fibre layer, ganglion cells and internal granular layer; the great alteration of the layer of rods and cones; the sclerosis of the retinal vessels; alteration of the pigment epithelium; atrophy of the chorio-capillaris; and absence of all evidences of inflammation.

Gonin, who also reports an anatomical study of the disease, calls attention to the same points, and also to the fact that the degeneration reaches a maximum in a circular zone. This distribution he ascribes to the arrangement of the vessels. (See Nettleship's Observations on Choroidal Disease.) He also emphasizes the degenerative as opposed to the inflammatory nature of the disease.

Lister, who reports the microscopic findings in a case, thinks that the concentric effect corresponds with the nerve distribution, rather than a vascular distribution; and therefore that the degeneration commences primarily in nervous tissues, rather than in a vascular system. He believes that the cases with sclerosis of the choroidal vessels represent a *secondary pigmentary degeneration* of the retina, whereas in typical retinitis pigmentosa no changes are seen in the

choroid or its vessels; although he states: "The choroid is atrophied and the chorio-capillaris layer has disappeared."

Henderson examined microscopically cases of pigmentary degeneration of the retina. But in one of his cases there were excessive changes in the choroid, and only one eye was affected. Probably it was a retinal degeneration secondary to choroidal disease. His other case was doubtless one of retinitis pigmentosa; but one eye was in a condition of absolute *glaucoma*. He calls attention to other cases in which *glaucoma* has supervened upon retinitis pigmentosa; and quotes the view of Weiss, that this association may be more common than is supposed. The patient, already blind, may not seek advice on account of the added *glaucoma*. Henderson seems to favor the view that the disease primarily affects the vessels. In his case the vascular alterations were very marked.

Stein, from a study of the pathological anatomy of 4 cases, discusses the differentiation of syphilitic chorio-retinitis, of which he reports one case, and retinitis pigmentosa, of which he reports two certain cases, and one doubtful case. Briefly, the anatomic difference is chiefly the greater evidence of inflammation, and more general alteration of the choroid in the former condition.

RETINAL FEEDING FOR ATROPHY.—Believing that in certain atrophic conditions of the retina its nutrition might be improved by an increase of some substance contained in the retina, Doyne tried feeding to his patients the retinas of sheep and oxen. He reports 5 cases of retinitis pigmentosa, 4 of tobacco amblyopia, and 2 of optic nerve atrophy treated by this method. All his patients reported marked improvement in vision. In tobacco amblyopia the improvement seemed much more rapid than it usually is in these cases. In retinitis pigmentosa vision was improved in one case from 6/24 to 6/12, and from 6/60 to 6/24 partly; and all spoke of the increased clearness of what they saw. Suspension of the retinal feeding was followed by deterioration in the vision.

The daily *dose* used was 6 to 10 retinas. These were given raw, and had to be perfectly fresh; for otherwise no benefit was experienced. Attempts were made, with apparent success, to secure an extract that would have the therapeutic value of the fresh retinas. In discussing Doyne's paper, Stephenson reported good results from the use of this extract in 3 cases of tobacco amblyopia, in spite of the continued use of tobacco. The necessity for having the retinas perfectly fresh makes the treatment somewhat difficult and expensive to carry out.

The treatment is one calculated to produce a strong mental effect. It has been used in cases which run a slow course, and vary considerably as to their acuteness of vision under influences quite apart from any line of treatment to which they may be subjected. Still this method is brought forward by a well-trained observer, who strongly believes it has proved beneficial. It should have a thorough trial; and the results, whether positive or negative, should be reported.

CEREBRAL DEGENERATION WITH RETINAL CHANGES.—Batten reports the case of a girl aged 7, with pigmentary changes all over the retina; and at each macula a reddish black spot about $\frac{1}{3}$ the diameter of the optic disk, while the region surrounding it was paler than the rest of the fundus. The child had been healthy until a year before, when she became very spiteful, had violent attacks of temper and was noticed to have failing sight. An older sister, in an asylum for some form of cerebral degeneration, showed similar ophthalmoscopic changes, with paleness of the optic disk, and smallness of the retinal vessels. These cases suggest an approach to amaurotic family idiocy.

MILIARY ACTINOMYCOSIS.—Mueller reports the case of a man aged 22, supposed to be suffering from miliary tuberculosis, in whose right eye was discovered a yellowish white spot one-fourth the diameter of the papilla, situated near the optic disk, upward and inward. A slight curve in the vein passing over it indicated that it protruded somewhat forward. It also appeared to be bordered by pigment. But

notwithstanding these points, and its yellowish color, it was regarded as a choroidal tubercle. Eleven days later four such nodules, the diameter of a large retinal vein, were discovered in the right eye and three smaller ones in the left. All lay in the neighborhood of the optic disk. The remainder of the fundus was normal. The patient died within a month after the first examination, and post-mortem was found to have suffered from miliary actinomycosis. Microscopic examination showed the choroid to be entirely normal, the dark border being merely due to contrast. The nodules lay in the retina. They contained no micro-organisms; but they were composed of large epithelioid, mononuclear cells, characteristic of the reaction of the tissues in actinomycosis, that causes the destruction of the invading organism.

DETACHMENT OF THE RETINA.—The liability of malarial poisoning to cause retinal detachment is illustrated by two cases reported by Terson. Two cases of *apparent replacement* of detached retina, coincident *with the rapid formation of cataract*, are reported by Lange. One of these had high myopia, had been seen before the detachment occurred, and also with the detachment, which reduced the vision to counting fingers at one meter, and greatly contracted the visual field. Both eyes were affected, with an interval of a little more than a year between. Twenty months after the detachment in the first eye, a total cataract seemed to form in the course of a very few days. With this the tension of the eye, previously lowered, became normal, and the projection of light good. Two months later a preliminary iridectomy was done, and the month after that, the lens was extracted. The retina appeared to be re-attached in every part. Three years after the extraction, the eye retained vision of $1/12$, a good field, and normal tension. The second eye rapidly developed cataract, 15 months after its retinal detachment; and with this a good field returned for light projection. The second case was quite similar, except that but one eye was involved, and cataract extraction had not been done.

A new operation for retinal detachment is suggested by

Mueller. He does Kronlein's resection of the outer wall of the orbit to expose the temporal side of the eye-ball. From this position he then excises a lens-shaped piece of sclera 20 mm. long, and 8 or 10 mm. wide. The length of this piece is parallel to the equator. Its anterior edge should lie 1 or 2 mm. behind the insertion of the external rectus, and its posterior margin about the equator of the eye-ball. The edges of the scleral wound are brought together by 5 sutures. The choroid and its contents should remain uninjured, except that before tying the scleral sutures, a narrow knife is thrust through the choroid, to allow the escape of intraocular fluid, as the eye-ball is made smaller by the closing of the wound. Mueller reported three cases in which he had done this operation and the retina remained in proper position 10, 11, and 15 months afterward.

Diseases of the Optic Nerve

RECURRING NEURITIS.—Caudron reports a case of recurring neuro-retinitis which he ascribes to periodical vascular disturbances following artificial menopause. It occurred in a woman aged 30, who two years before underwent removal of the uterus and ovaries. Both eyes were affected. The left was the worse and exhibited small retinal hemorrhages. In the interval of the attacks vision rose almost to normal.

Yamaguchi reports a case of sarcoma of the frontal lobe in which severe optic neuritis occurred, followed by atrophy and complete blindness. The optic nerve remained unaltered for nearly a year, when it became again swollen to 3 D., with choking of the vessels and hemorrhages. The symptoms pointed to thrombosis of the central vein and this was demonstrated at the autopsy.

NEURITIS FROM CEREBRAL DISEASE.—Two cases of cerebral cysticercus with choked disk are reported by Jacoby. Both cases ended in early death by hyperpyrexia. The relative importance of cysticercus in causing choked disk in some

countries is not brought out in most of the descriptions of optic neuritis. Thus, at Breslau, among 716 cases of gross cerebral disease coming to autopsy, 92, or almost 13 per cent, were of cysticercus. The tumors of the brain and meninges numbered only 106, less than 15 per cent. In this country cysticercus is less common; so unusual that it is liable to be overlooked.

Relief of Intracranial Pressure.—In cerebral disease attended with optic neuritis, operation to diminish intracranial pressure may be indicated to avoid blindness. Abadie reports a case of Jacksonian epilepsy following traumatism, with double optic neuritis, and vision diminishing. Lumbar puncture was followed by rapid recovery of what vision had been lost; and a course of mercury effected a complete cure.

Dianoux discusses at length the question of operation, to prevent blindness from optic neuritis associated with cerebral tumor. He holds that impending blindness is a sufficient indication for operation; and that it should be done promptly when vision begins to fail. Lumbar puncture is the simplest operation and it produces an excellent effect. But its effects are usually temporary. He advises that it be done as soon as the indication arises. But that if the vision again begins to deteriorate, craniectomy should be resorted to. The craniectomy may be simple, or it may be combined with incision of the dura mater, or carried to a search for the cerebral growth. Dianoux reports two cases in which it was followed by most satisfactory improvement, and one in which it was delayed until complete blindness supervened, when it proved useless.

Optic Neuritis from Purulent Meningitis.—A microscopical study of five cases of neuritis occurring in fatal cases of purulent meningitis, most of them from suppurative disease of the middle ear, are reported by Lieto-Vollaro. The tendency to universal involvement in the suppurative process of the various tissues of the nerve trunk was very evident.

OPTIC NEURITIS WITH INFECTIOUS DISEASE.—Gamble reports a case of double neuritis complicating *whooping cough*, and collects three similar cases from the literature. All occurred in girls from 6 to 12 years of age. In three cases there was great impairment of vision. One of these recovered entirely; two went on to optic atrophy; and in the fourth case vision continued normal throughout. In two cases there was evidence of serious cerebral disease, to which the optic neuritis may have been secondary. In the other two it might be ascribed to the action of the toxins directly upon the nerve tissue. A lesion affecting but one optic nerve might be ascribed to hemorrhage into the nerve sheath.

Sourdille has observed four cases of visual trouble complicating *typhoid fever*. In one of these there existed no ophthalmoscopic lesions. In the others there was evidence of neuritis, with especial involvement of the central vessels. These cases all recovered. By the microscopic examination of six fatal cases, Sourdille found in one a marked chromatolysis of the ganglion cells of the retina, while the optic nerve was normal. In the other cases the retina was normal, but the central vessels showed hyaline degeneration of the walls. He believes that the visual disturbance may be due to either the effect of the toxins upon the nervous elements, or to vascular lesions.

Optic neuritis connected with *syphilitic orbital periostitis* is reported by Hotz. Vision was reduced to counting fingers at 6 inches with the right, and perception of light with the left eye. The optic disks were swollen and cloudy, and the veins dilated and tortuous. The eye-balls were prominent and pressure back into the orbit caused pain. Both eyes recovered normal vision and normal ophthalmoscopic appearances.

Another case of *syphilitic disease* of the optic nerve is reported by Schieck. Both eyes were involved and there was a central scotoma in each, but no tenderness on pressure of the eye-ball backward, and no redness or swelling of the nerve head. Schieck is inclined to explain this case upon the

hypothesis of a vascular lesion. In another case occurring with myocarditis, and a third in which there was thrombosis of the central vein, the connection with vascular disease is also emphasized.

TRAUMATIC NEURITIS.—Wilmer reports a case of absolute blindness from optic neuritis, which was followed by complete recovery. The patient, a healthy girl of 8 years, was struck on the nose with a baseball bat, causing free bleeding from the nose, although she was not knocked down or rendered unconscious. Three days later she awoke to find the right eye blind; and next day the sight of the left began to fail. She was seen on the 9th day after the accident. $V=0$ in each eye. The pupils were widely dilated and immovable. There was exophthalmos on the right side. The child was given calomel ($\frac{1}{8}$ grain) every half hour; and ice applications were made externally. In four hours she could locate the bright light from a window. Next day she had good light perception. The ice was continued and potassium iodid was given. At the end of one week $V=1/200$ in each eye, and in seven weeks vision was normal. Wilmer also gives 5 cases in which traumatism was followed by more or less optic atrophy, and permanent impairment of vision.

IDIOPATHIC OPTIC NEURITIS.—A case of complete blindness, so that the pupil did not react to light, with marked papillitis and choking of the retinal vessels, is reported by Kipp. When first seen only the left eye was blind, the right having $V=5/12$; and light thrown into the right eye caused both pupils to contract. But next day it also had lost light perception. Ability to distinguish between light and darkness was recovered 5 days later. At the end of one month $V=R. 5/18; L. 5/36$, with good fields in both eyes. At the end of three months vision was about normal. This patient was given potassium iodid up to 20 grains three times daily. She had suffered frontal headache for some weeks before the blindness occurred; otherwise she was healthy, with no history of syphilis, and with two healthy children.

OPTIC ATROPHY: *Unusual Forms*.—Taylor believes that a good many cases of primary optic atrophy, associated with overactive or sluggish knee-jerks, ultimately develop into cases of general paralysis. With disseminated sclerosis the atrophy may follow a retrobulbar neuritis. In these cases the deterioration of vision is rapid, yet it does not go on to complete blindness. Occasionally atrophy with central scotoma is followed by diabetes. Atrophy is occasionally seen to follow hemiplegia. Primary optic atrophy associated with severe headache, and special impairment of the temporal field of vision, is indicative of *tumor pressing upon the chiasm*. Yamaguchi reports 4 cases of atrophy from tumor involving the chiasm in which there were *marked menstrual disorders*. In three of his cases menstruation had ceased about the age of 30 years. He cites a series of other cases in the majority of which menstruation had ceased before the age of 40, and calls attention to the early menopause of akromegaly. There seems to be an essential relation of early menopause and primary optic atrophy, of this particular form, with tumor of the hypophysis or adjoining parts.

ATROPHY FOLLOWING HEMORRHAGE.—Sweet reports the following case: A healthy man of 55 suffered a severe intestinal hemorrhage, so that eleven days later his blood showed hemoglobin 38 per cent and red cells 2,088,000. On the sixth day objects seemed hazy, and by evening light could only be recognized in a small area to the right. Up to this day vision had been normal. Three days later light perception was confined to a small area to the temporal side of the fixing point in the right eye, while the left was absolutely blind. The retinal arteries were moderately contracted, the veins normal, the disk pale and the retina edematous around the fovea. In the right eye a cilio-retinal artery passed toward the fovea. The left eye remained absolutely blind. The field of the right gradually extended to the fixing point; and four years afterward V=20/20, although the field was still very much contracted. The optic nerves were atrophic, the left being slightly the more so.

The result in Sweet's case, one eye blind and the field of the other greatly contracted, is not a bad result as such cases go. Coming to the specialist many days or weeks after the blindness has occurred, very little can be done for them. But probably by *early treatment* vision might be restored in nearly all of the cases. This was pointed out years ago by Terson, who recommended large injections of artificial serum, or a saline solution. He now reports a case in which this was carried out with the happiest results. Hemorrhage during labor was followed by syncope; and, on reviving from the syncope, by blindness. The physician in charge, Dr. Poinot, gave a large injection of salt solution, and the next day the patient's vision was quite restored.

TABETIC ATROPHY.—The early symptoms of tabes are rehearsed by Fabre as those of a "pre-atrophic stage" of tabetic atrophy. He mentions muscular palsies, accommodative asthenopia, alteration of the differential light sense, dyschromatopsia, peri-orbital neuralgia, anesthetic areas, narrowing of the palpebral fissure, epiphora, myosis, the Argyll-Robertson symptom, alternating contraction and dilation of the pupil, inequality of the pupils, and clonic spasms of the ocular muscles. Fabre urges that the co-existence of several of these symptoms should be taken as evidence of this pre-atrophic stage; and mercurial treatment resorted to at this time, when it is likely to be beneficial. If left until atrophy is begun it is generally useless.

Dor believes that *potassium iodid* is quite useless, or even harmful in this form of optic atrophy. Of 12 patients, he treated 6 with the iodid until 4 had become blind. Stopping this treatment, the other two cases seemed to grow worse a little more slowly. In 6 other cases he used no iodid; but gave zinc phosphid to one; and to the others strychnia hypophosphite. In three of them the atrophy was arrested at a point that allowed them to read readily; and this vision had been retained from 8 months to three years. One patient died of general paralysis; one became blind; and one had only been a short time under treatment.

UNCERTAINTY OF VISION IN OPTIC ATROPHY.—The risks of basing an opinion regarding optic atrophy on the ophthalmoscopic symptoms, and of giving a positive prognosis as to vision in these cases, are illustrated by one of the Lourdes cures reported on by David. A man of 36 who went to the shrine with a certificate from de Lapersonne of "blindness, total and incurable, since three years, in consequence of atrophy of the papilla," has been widely heralded as having recovered his sight by miracle. Subsequent examination showed that he had vision of $1/50$ and $1/100$, which later declined to counting fingers at 2 meters. There is nothing in the history of the case to exclude the sort of malingering which becomes second nature to the professional beggar.

HEMORRHAGE INTO THE OPTIC NERVE SHEATH.—A good deal has been written about this condition; and in many cases it has been put forward to account for the observed symptoms. But Gonin points out, that in the only cases in which it has been demonstrated anatomically, the condition of the patient prevented any determination of acuteness of vision, or of measurement of the visual field; and that the only ophthalmoscopic symptoms observed in connection with it have been those of a slight degree of stasis of the central retinal vessels, with or without hemorrhage along the vessels. In the clinical picture of those cases which are known to be of this character, there is nothing distinctive upon which a positive or strongly probable diagnosis might be based.

Toxic Amblyopias

METHYL ALCOHOL BLINDNESS.—Scherer reports five cases; four of them following one debauch, in which an indefinite quantity of methyl alcohol was used. All who participated suffered blindness. One of them finally recovered vision of $6/9$ and $6/12$. The others remained blind, and one died. Main has collected 12 fatal cases occurring in his neighborhood (Barry, Ill.) during the last few years. He

found that various "extracts," on sale in that region, were made with this drug instead of ethyl alcohol. Turner and Posey report additional cases in which the wood alcohol was taken as "extract of Jamaica ginger." In connection with this form of amblyopia the suggestion of Hunt (Johns Hopkins Hospital Bulletin, 1902, p. 213) should be acted on: that since sodium bisulphate increases greatly the elimination of formic acid, it would be well to ascertain the therapeutic value of the drug in cases of alcohol poisoning.

THE URINE IN TOBACCO-ALCOHOL AMBLYOPIA.—To study what factors of autointoxication might share in the production of this form of amblyopia, de Schweinitz and Edsall have submitted the urine of patients suffering from tobacco amblyopia to thorough analysis, according to methods of modern physiological chemistry. They have endeavored to regulate the patient's diet until the urine was made to conform to the normal standard; and have noted the effect of such treatment upon the amblyopia. They report the results of such a study of seven cases, in five of which the stomach contents were also examined. They found in these cases marked disturbance of digestion or metabolism, or both; and that the disturbance might persist for a long time after the use of tobacco or alcohol had been stopped. In four cases they found the proportion of volatile fatty acids very high. But in two such an increase was uncertain, and in one case the proportion was normal. In all cases, however, there was an excessive excretion of enterogenous decomposition products in the urine. In all the patients repeatedly examined, these abnormalities nearly or quite disappeared under treatment, coincident with improvement in the eye conditions. In one case, although there had been previously more than a month of abstinence from tobacco and alcohol, the marked restoration of vision exactly corresponded with restoration of the urine to normal. Another patient who had not used tobacco or alcohol for 17 months, improved so much under this treatment that he was willing to continue the strict diet on which he had been placed.

QUININE AMBLYOPIA.—This is almost always bilateral. But in Graefe's case only one eye was affected; and a second unilateral case is now reported by Westhoff. The amblyopia had once disappeared, but recurred on taking a large dose of quinine. Vision was reduced to $3/24$ in the affected eye. The quinine was stopped; and three weeks later vision had risen to $4/8$.

Reina reports a case in which nearly $2/3$ of an ounce of quinine was taken at a single dose. Central vision was $1/3$, but the field was greatly reduced, the optic disks very white, and the retinal vessels thread-like.

RARE TOXIC AMBLYOPIAS.—Two cases of *amblyopia from male fern* (Filix Mas) are reported by Haberkamp. His patients were men who took the drug for anchylostoma. One of them took 10 grammes of the ethereal extract, repeated the dose in two days, causing sickness and vomiting, and two days later took a third dose. He suffered severe general symptoms, and at the end of 36 hours woke to find himself quite blind. There was venous congestion of the retina and haziness of the disk margins. After four days he recovered perception of light. Ultimately vision of $3/50$ was regained, and the optic disks became extremely pale. In the other case 8 gramme doses were given in the same way. After the third dose the patient remained entirely blind. There was at first a grayish red blurring of the disk, and later extreme pallor and shrinking of the arteries.

Amblyopia from coffee is reported by Wing. A boy 8 years old took 6 or 8 cups of strong coffee daily. Vision was reduced to $22/100$, with great narrowing of the fields. Coffee was stopped and he was given strychnia, $1/50$ of a grain three times daily. In 8 days his vision had risen to $20/20$, with improvement of the fields. Ultimately he gained vision of $20/15$.

Baum reports a case of *amblyopia from oil of wintergreen*, given for gonorrheal arthritis. After taking 24 c. c. of the oil in 48 hours, the patient suffered from yellow vision and inability to read. The drug was discontinued, and recovery occurred about the fifth day.

A case of amblyopia following poisoning from *potassium chlorate*, is reported by Roselli. The patient complained of distortion of objects, and their misty appearance. Ophthalmoscopically the whole fundus was said to have appeared somewhat pale. Recovery was complete in a week.

Diseases of the Crystalline Lens

CAUSES OF CATARACT.—Uribe-Troncoso has studied the etiology of cataract by careful analysis of the aqueous humor in seven cases representing the different stages of its development. He finds that in commencing cataract the aqueous humor does not contain more albumin than normal. But in early nuclear cataract there is a considerable increase in the proportion of saline constituents. This is not observed in commencing cortical cataract. As the cataract arrives at maturity, the aqueous approaches the normal composition. In hypermature cataract the proportion of organic matter in the aqueous is increased. The increase of saline constituents during the period of commencing cataract, Troncoso believes tends to produce dessication of the nucleus and alteration of the peri-nuclear zone.

Robinson points out that among glass workers it is the bottle finishers who are specially liable to suffer from cataract. They have to look into the furnace each time they take the glass for the rim of a bottle, making an aggregate of exposure to the glare of the furnace of about $5\frac{1}{2}$ hours a week. The opacity begins at the posterior pole of the lens, as often before the age of 50 as after. The disease can be prevented by wearing dark blue spectacles which exclude many of the light rays and about 70 per cent of the heat rays. Robinson thinks that there is no valid objection to the use of such spectacles while the men are at work.

Jervay suggests that senile cataract may be started or aggravated by friction of the iris roughened or hardened by

disease; and without any observations that sufficiently support his hypothesis he goes on to suggest that the process can be arrested by an appropriate operation, sphincterectomy.

APPARENT CATARACT.—To show the student a gray senile lens, and after his diagnosis of cataract, to demonstrate its transparency with the ophthalmoscope, is a common method of enforcing the importance of the ophthalmoscopic examination. The sector shadows of irregular lens astigmatism sometimes encountered in skiascopy may bear a startling resemblance to the opacities of commencing cortical cataract. Other lens changes without opacity simulate early nuclear cataract. Halben has reported a case of the kind with a careful study of the causes of this phenomenon.

To explain these cases, Halben very carefully considers the reflections which occur from the surfaces of the lens, and of its different layers; both of the light entering the eye, and of the light emerging from it during the ophthalmoscopic examination. Light entering at certain angles may be turned back by even total reflection, giving the gray appearance seen by ordinary daylight. On the other hand the light from the fundus may encounter the surfaces of the different layers of the lens at such angles that it will be largely turned back within the eye, giving the shadow shown in the particular ring of pupil where the layers have this particular inclination required.

MEDICAL TREATMENT FOR CATARACT.—Verderau produced traumatic cataract in rabbits and injected a few drops of 5 per cent solution of potassium iodid into the crystalline lens, and also subconjunctivally. From the subsequent clearing up of the lens he concluded that this drug had a marked effect upon lens opacities, arresting their progress and favoring retrogression. It should be remembered, however, that in rabbits the tendency to repair lens injuries is very much greater than it is in man. It is often difficult or impossible to render the lens opaque by repeated needling. Randolph, experimenting with young rabbits (Johns Hopkins Hospital Reports, Vol. IX), after the removal of the

lens in 20 cases found it completely reformed in 4, and partly in 4 others.

It is quite as likely that clearing up of the lens in Verdera's experiments occurred in spite of the injections of potassium iodid, as that it was assisted by them. Even though the iodid proved beneficial in rabbits, the difference in natural power of repair makes such results worthless as a basis for any deduction regarding the treatment of cataract in human beings. There is such a tendency, even among physicians, to be misled by hopes of an "absorption cure" for cataract that it is worth while to point out and emphasize even the most evident sources of fallacy regarding alleged advances in this direction.

CONGENITAL DISLOCATION OF THE LENS.—Marlow reports 6 cases occurring in one family, and traces abnormality of the eyes, probably of this character, through 5 generations. In only one of these cases was the lens utilized in the act of vision. The others used the aphakic portion of the pupil. Stoewer reports 2 cases in which with the pupil undilated the patient was compelled to look through the lens margin. Iridectomy, done to give an aphakic pupil, gave, with the correcting lenses, improved vision.

The extensive degenerative changes set up by a dislocated lens have been studied by Wernicke. He calls especial attention to the formation of a hyaline membrane on the cornea, iris and choroid; the excavation of the optic nerve head; the formation of peculiar coiled fibrinous threads in the remains of the lens, and of a chalky layer on the retina and walls of the anterior chamber. Marlow, from one of his cases, aged 22, removed one eye for buphthalmos. It had been enlarged from birth, and for the last four years staphylomatous.

CATARACT OPERATIONS

SUBCONJUNCTIVAL EXTRACTION.—Czermak describes a method of extraction of the lens downward, through a subconjunctival sac. A wide Graefe knife is entered through the limbus at the temporal side of the eye, just below the

horizontal meridian, and thrust forward in front of the pupil (as shown in Fig. 29); or preferably into the lens capsule. The knife is then withdrawn, and scissors used to make an incision downward in the conjunctiva (as shown in Fig. 30).

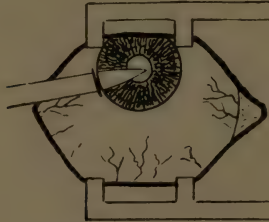


Fig. 29.

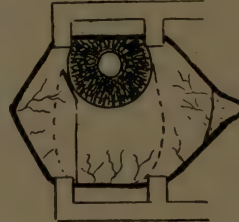


Fig. 30.

Czermak's Subconjunctival Extraction Operation.

This incision in the conjunctiva extends downward 12 to 15 mm. Then one point of the scissors is introduced into the anterior chamber and the other between the conjunctiva and sclera (as shown in Fig. 31), and by successive snips a suf-

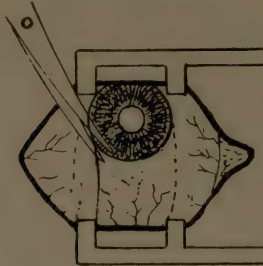


Fig. 31.

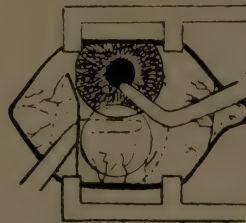


Fig. 32.

Czermak's Subconjunctival Extraction.

ficient section, approaching a half circumference of the cornea, is made in the lower sclero-corneal junction. With the closed scissors the conjunctiva is separated from the underlying tissue to form the conjunctival sac, outlined in Figs. 30 and 31 by the dotted line. The cystotome, or better a sharp iris hook, may now be introduced; and the capsulotomy may be completed in the usual manner. Pressure is

then made with a spatula on the upper corneal margin, and counter pressure by a second spatula, introduced into the subconjunctival sac, and the lens is thus delivered beneath the conjunctiva. It can then be pushed out from under the conjunctiva with the upper spatula (see Fig. 32). Czermak uses the curved spatula of Knies, but this is not essential. As a final step the conjunctival incision is closed by one suture, which may remain for three or four days.

PREVENTION OF POST-OPERATIVE INFECTION.—The advantages of the above operation in an eye liable to subsequent wound infection are evident. Another ingenious and successful modification of the usual cataract extraction, to guard the section from conjunctival infection, is described by Ellett. The patient had a persistent conjunctival discharge which active and persistent treatment failed to remove; and Ellett did the following operation: The conjunctiva was divided all around the cornea, as if for enucleation, and dissected back by means of a probe, upward and downward to a distance of $\frac{1}{2}$ inch. The cataract was rapidly extracted with iridectomy. The loosened conjunctiva was then drawn together by a line of sutures across the middle of the cornea. Care was taken to secure exact apposition of the conjunctival flaps; and iodoform was thickly dusted on the line of union.

The eye was irrigated every hour with boric acid solution; and iodoform reapplied after each washing. The conjunctival stitches were removed on the fourth day and the retraction of the conjunctiva immediately exposed about one-fourth of the cornea. Three days later the whole cornea had been exposed by the retraction of the conjunctiva, which re-attached itself in normal position. The eye healed without accident; and without corneal astigmatism, which Ellett ascribes to the uniform pressure upon the cornea.

OPERATION WITH OVERLAPPING CORNEAL FLAP.—Muel-ler has used the following operation for cases in which it is important to secure an immediate firm closure of the corneal wound. He first makes a superficial flap by passing a very narrow Graefe knife from *a* to *b* (Fig. 33), so as to include

only part of the thickness of the cornea, the distance ab being about 5 mm. He then causes the knife to cut out at cd , the width of the flap ac and bd being about 2 mm., and the knife being turned forward at cd so as to make a square flap. Stitches are then introduced in the angles of the flaps, as shown by the dots, and this flap is drawn aside. A corneal section starting from the line ef is made in the sclero-corneal junction as for ordinary simple extraction; except

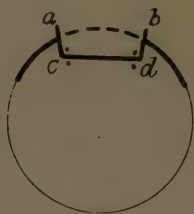


Fig. 33.

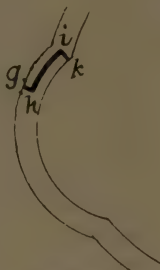


Fig. 34.

Mueller's Double Corneal Flap Operation for Extraction of Cataract.

that this section cuts into the one already made at ki (Fig. 34), leaving the first flap undivided. The lens is then removed in the ordinary way and the stitches already inserted in the first flap are carried into the cornea at c and d (Fig. 33), or g h (Fig. 34). The tying of these sutures closes tightly the corneal wound.

The operations of Czermak and Ellett give considerable security against prolapse of the contents of the eye-ball, but Mueller's method is decidedly superior in this respect. On the other hand it gives comparatively little protection against probable infection of the corneal wound.

EXTRACTION THROUGH THE SCLERA.—Gradenigo, to avoid any corneal opacity, distortion of the pupil or synechia, has resorted to a form of scleral extraction. His incision is made just behind the root of the iris. He makes a puncture and counter-puncture a few millimeters apart, with a Graefe knife, and divides the intervening tissue. The incision is

then completed by scissors, one point of which is introduced through this opening. He divides the zonule opposite the scleral incision with a special instrument, and then extracts the lens in its capsule. Gradenigo gives no statistics or exact report of the results obtained by this operation; and Evans in reviewing it (*Ophthalmic Review*, Nov., 1903) says he has found the reaction marked, and in one case sympathetic ophthalmia ensued. It is an operation that I would not mention on its own account; but often a method which one would not use may prove suggestive when a problem is to be dealt with that requires for its solution some departure from ordinary methods.

EXTRACTION IN THE CAPSULE.—According to the statistics reported by Major Smith from his service in Jallundhar, India, cataract extraction seems to have reached its highest development in this form. He reports 1023 operations, done in four months, with 99.42 per cent of "first class results"; 0.19 per cent of iritis; two cases of suppuration; two eyes lost by hemorrhage; and one vitreous forced out by muscular action on the completion of the incision. In 982 cases in which he succeeded in extracting entire in the capsule, there was no case of iritis. This complication was confined to the cases in which he was forced to leave a portion of the capsule behind. Escape of vitreous occurred in 6.6 per cent of the cases. During the same period Smith encountered 60 cases which he considered unsuitable for extraction in the capsule.

The incision he used was started as deep in the sclero-corneal junction as he could go without wounding the dangerous area, and cut out in the cornea half way between the normal pupil and the corneal margin. After completing the incision the speculum was taken out, and an assistant held up the upper lid on a large strabismus hook, and drew down the lower lid by the ball of the thumb placed on the skin below. The patient must not be allowed to exert any pressure with the orbicularis until the operation is finished. The operator then presses on the cornea at the junction of the lower and middle thirds, with the curve of a strabismus

hook, and makes counter-pressure with a spoon just above the upper lip of the wound. The pressure with the strabismus hook on the cornea should be slow, steady and uninterrupted. When the lens is more than half out, the hook is moved forward so as to get the edge of the lens within the concavity. If this were done roughly or with a sharp instrument the capsule would give way, allowing the lens to escape, and the capsule to retract within the eye-ball. Smith had the capsule give way in 8 per cent of his cases, but in one-half of these he was able to catch it with forceps and remove it.

The lens being extracted and any protruding vitreous snipped off, the eye is at once closed. Smith attaches importance to the prompt closing of the eye. He says: "The only sponging, washing or douching I use is a preliminary washing out of the conjunctiva with a 1:2000 perchloride of mercury solution. After the lens in the capsule comes out if we go 'fiddling' we are sure to have an escape of vitreous."

The cases considered unsuited in this operation are cataract in children, atrophic cataract, and that in which the nucleus is surrounded by semi-gelatinous material. Evidently the ease with which the zonule separates and the liability of the capsule to rupture during the operation must have a very important influence in determining the suitability of this form of operation. And these factors may depend a good deal upon racial peculiarities. This may be the reason that extraction in the capsule has fallen into disuse among Europeans and their descendants. On the other hand it is possible that an improved technique has more completely developed the value of this form of operation.

METHODS OF OPENING THE CAPSULE.—Probably nothing short of the adoption of extraction in the capsule would settle the discussion about methods of capsulotomy. Terson writes a rather extended paper, the conclusion of which is: that generally his capsule forceps with but two teeth are the best instruments for opening the capsule, although in exceptional cases the same model with three or four teeth may be pre-

ferred. Barck believes he has solved the problem by making the incision in the capsule in the shape of an inverted Y, the two branches meeting somewhat above the center of the capsule. Erwin undertakes to transfix the capsule as he carries the point of the knife from the puncture to the counter puncture of the corneal sections; and then cutting upward, claims to make an incision in it the shape of an inverted U.

I believe that the smooth healing of the eye after cataract extraction depends largely upon leaving no lens substance within the eye, and outside of the capsule. Therefore Knapp's method of opening the capsule by a horizontal peripheral incision is to be preferred to any plan that favors the escape of cortex into the anterior chamber.

INTRACAPSULAR IRRIGATION.—Reik's paper on this subject urges that the introduction within the eye of a sterilized saline solution is harmless. That irrigation is more efficient in removing cortex than any other method; that it also removes blood and bubbles of air; and is effectual in making the toilet of the wound. His paper provoked an interesting discussion, largely favorable to irrigation. Lippincott had employed irrigation for 15 years, still preferred it, and supported his preference by statistics of good vision following extraction with irrigation. Holt, Allyn, Clarke, Buller, St. John and Wilmer all favored irrigation, either in certain cases or as a routine part of the operation.

ARTIFICIAL RIPENING OF CATARACT.—Along with a discussion of other methods, Fage describes the following which he employs. The pupil being dilated he makes a small opening in the center of the anterior capsule with a narrow cataract knife introduced obliquely near the margin of the cornea. With the withdrawal of the knife the aqueous humor is allowed to escape, and massage of the lens through the cornea is practised. In this way he gets more rapid ripening of the cataract than by massage alone, and without the additional risk which would attend a larger incision in the capsule.

DEPRESSION OF CATARACT.—With the tendency to revive this operation for certain rare cases we find no full description of it in our later text-books. Albertotti has chosen a reclination loop, which is a flattened ring 6 by 5 mm. in diameter, having a gap of almost $\frac{1}{4}$ its circumference on one side of the stem. It is slightly curved on the flat. This loop may be nearly in the plane of the stem or at right angles to it. It is introduced through a puncture made 2 mm. within the lower margin of the cornea, oblique to the corneal surface, in such a way that when the handle has made its complete revolution the ring lies within the eye, its upper portion behind the upper segment of the iris. With the corneal opening as a fulcrum the operator, by raising the handle of the instrument, depresses the lens; tearing the suspensory ligament above. The lens is to be held down for at least a minute and a half. Then, if it remains in its new position, the loop may be withdrawn by a corkscrew movement, the reverse of that used to introduce it. During the operation the patient should be in a sitting posture, or at least have the head well elevated.

From his experience in India, Maynard reports the late results of 63 operations for depression of the lens. Of these eyes, 39 had obtained fairly good vision, which 29 of them still retain; 13 had light perception; 13 had no vision, altho the eye looked well; and 8 had shrunken globes; 15 had retained good vision for one year or less; and 16 had kept it for five years or more, and 7 of these for ten years or more. The results were better when the lens became fixed in the vitreous. Increased tension was shown in 10 of the eyes, 4 of which still had good vision. Good vision remained in one case 12 years after couching, with —T 2.

In 35 cases subsequent extraction was done on the fellow eye, with 8 failures, seeming to show an unfavorable influence exerted by the couching in the first eye. In 2 cases extraction of the dislocated lens was attempted. One attempt was successful. In the other case the lens was too firmly fixed to be removed. Bouchart reports a case of the spon-

taneous expulsion of the depressed lens during an operation for iridectomy.

ABSORPTION OF THE LENS AFTER TRAUMATISM.—Armaignac believes that the danger of attempting to secure absorption of the lens after the age of 20 or 25 years has been exaggerated. He finds that before 40 many traumatic cataracts, that are not interfered with, are completely absorbed without serious complications. After that age the process goes on slowly. But he believes it is possible at all ages. However, the danger of glaucoma increases with age; and after 35 he thinks it wise to evacuate at least a part of the lens.

Diseases of the Vitreous

MYCOTIC INFECTION.—Kampherstein reports the case of a girl whose eye had become inflamed after a sting on the lower lid. But the eye-ball showed evidence of an earlier disorganization, probably from a punctured wound of which no history could be obtained. On microscopic examination a fungus mass composed largely of isolated threads was found in the vitreous. These threads stained best with hematoxylin and Weigert's fibrin stain. No spores were found. The growth seemed most nearly to resemble *aspergillus flavescens*. But it might have been a *pencilium*. Three cases have been previously reported, from one of which cultures of *aspergillus fumigatus* were obtained and recognized. In one other case this vitreous lesion was associated with *aspergillus keratitis*. In all cases there has been evidence of a wound or the perforation of the globe, and the eye-ball has been seriously disorganized.

CYSTICERCUS.—Intraocular cysticercus has very rarely been observed in this country. A case is reported by Wurdemann in which the sac with its protruding head was recognized on the upper temporal artery of the left eye, nearly over the nasal side of the macula. Its base was attached to

a hemorrhage from the artery. The head was free in the vitreous, apparently had six hooklets, and was made to change position, especially by the light of the electric ophthalmoscope. The vitreous of the other eye was fluid, with detached retina and a history that agreed with Wurdemann's diagnosis of cysticercus in that eye. No other case of both eyes affected with cysticercus is on record.

Guiot reports a case in which the vesicle was situated close behind the posterior surface of the lens. In the absence of urgent symptoms he was disposed to defer operation. In this case there was some doubt as to the diagnosis. Although the patient gave a clear history of rapid impairment of vision, the vesicle remained unchanged after 3 months.

Suesskind reports a case of vitreous opacity in a 9-year-old scrofulous girl, in which the diagnosis of choroidal tuberculosis was first made. But with six subconjunctival injections of salt solution the vitreous cleared up so much that a diagnosis of subretinal cysticercus was readily made; and the parasite removed through a scleral incision.

INJECTIONS OF GELATIN FOR RECURRENT HEMORRHAGES.—This method of treatment has been employed by Fromaget in four cases, two of which he thinks are of sufficiently long standing to give positive indications as to the value of treatment. One patient had previously lost one eye from repeated hemorrhages. When his second eye became seriously involved he received four hypodermic injections of gelatin; and it remained in quite satisfactory condition nearly four years afterward. The other patient was quite blind in both eyes when he received six injections. He recovered good vision; and two years afterward both eyes were still in excellent condition.

The gelatin was given in 2 per cent solution, injected under the skin of the abdomen. In the first case two injections of 50 c. c. were given three days apart, and six months later two more injections of 100 c. c., with an interval of two days. In the second case the dose was 150 c. c., and was repeated every three or four days until six injections were

given. Fromaget does not state the exact acuteness of vision in either case.

Glaucoma

PATHOLOGY AND CAUSATION.—The hope that careful study of the *cervical sympathetic* might throw some light on the essential nature of glaucoma has not been fulfilled. According to Weeks: "We cannot say that there is any constant change in the cervical sympathetic peculiar to glaucoma, although we cannot exclude the possibility of such change." Wahlfors, from an extended review of the subject, concludes: "In glaucomatous increase of tension three factors are at work—the paralysis of the muscular net-work of the choroid, causing a slowing of the currents of liquid; the channels of exit, which in consequence of the retarded flow through the deposits of the formed elements, become blocked and cause a retention of the ocular liquids; and finally the anatomical arrangement of the *venae vorticosae*, which are compressed by the increased tension, and thus lead to a general venous stasis, with all its results."

In simple glaucoma he holds that atrophy of the choriocapillaris causes the early impairment of the rods and cones. With reference to the blocking of the channels of exit, he believes that so long as there is space to insert a knife in the angle of the anterior chamber for iridectomy, this channel must be free for purposes of drainage; and the check to escape of fluid must be situated in the fine canals leading from this angle to the circumcorneal veins. Congestion must increase the obstruction and intraocular stasis. Wahlfors would use the term "congestive" glaucoma rather than inflammatory.

In an experimental study of the relations between *intraocular tension* and the *general blood pressure*, Parsons found that the effect of the extraocular muscles upon the tension

of the eye-ball was so great, that it was necessary to fully curarise the animal before results of any value could be obtained. The marked rise in intraocular pressure produced by stimulation of the cervical sympathetic, he finds is not due to any alteration in the general blood pressure, but rather to contraction of unstriated muscular fibre in the orbit. The intraocular tension, however, responds passively to all variations in the general blood pressure, whether these be produced by mechanical means, by stimulation of sensory nerves, by drugs, or by asphyxia.

These changes may be regarded as due to alterations in the volume of the intraocular blood vessels rather than to changes of secretion. Whether such passive changes are sufficient to account for the glaucomatous attacks produced by excitement or emotion is uncertain. Striking instances of this kind have been noticed by every ophthalmic surgeon of large experience. Trousseau gives a series of cases of the sort. In a case reported by Scheer, the attack followed the striking of the eye by a grass seed. It is quite possible that under these circumstances alterations of secretion occur, that might not be produced by mere changes of blood pressure.

Increased dilatation of the pupil, too, may be a factor. Its importance in producing glaucomatous attacks is again illustrated by Ring's case of glaucoma excited by the use of euphthalmin. His case also illustrates the benefit which may result to the patient from such an occurrence, by inducing him to submit to an early iridectomy. In this case the vision was restored to normal by operation.

INFLUENCE OF ADRENALIN.—Darier recommends the addition of this drug to the solutions of myotics used for glaucoma; and he reports very beneficial results from such collyria. Pointot also favors its addition to the serum gelatin, which he advises for subconjunctival injection in hemorrhagic glaucoma. But there is reason to employ adrenalin in glaucoma, with extreme caution. MacCallan reports five cases in which striking increase of intraocular tension fol-

lowed the use of adrenalin in glaucoma. Sometimes it was used in conjunction with eserín and cocain; in other cases it was employed in preparing the eye for iridectomy. In discussing MacCallan's paper, Harman also reported a case that indicated its use was not without danger. De Schweinitz calls attention to the fact that after sympathectomy, adrenalin causes a marked dilatation of the pupil. It might on that account prove dangerous.

RETINAL DETACHMENT IN GLAUCOMA.—The coincidence of glaucoma and retinal detachment in the same eye is rare, but not so rare as was formerly believed. Birsch-Hirschfeld reports a case in which the glaucoma seemed to precede the detachment of the retina. Kampherstein records one in which the retina seemed to be forced into the glaucomatous excavation in the head of the optic nerve. Hillemans divides the cases of glaucoma with retinal detachment into four groups: (1) Where there is a common cause for both conditions; most frequently tumor. (2) Where the glaucoma is the original disease, and the detachment occurs during the stage of degeneration. Usually it occurs late in these cases, but it may occur before vision has been entirely lost. (3) Detachment of the retina may be followed by irido-cyclitis, which may set up glaucoma. (4) Cases without any common cause and no definite evidence as to which disease appeared first.

GLAUCOMA AFTER CATARACT EXTRACTION.—This usually follows some operation for secondary cataract. But in a few cases it occurs without any secondary operation. Elschnig reports a case in which severe glaucoma occurred within a month after leaving the hospital, after the cataract extraction. The eye was enucleated; and on microscopic examination it was found that the whole anterior chamber was lined with epithelial cells, which appeared to be an abnormal ingrowth from the anterior corneo-scleral surface. The epithelium covered the inner surface of the cornea, the anterior surface of the iris, and even the lens capsule.

Bordley reports a case in which the glaucoma occurred in

the left eye within two months after the extraction; and appeared to be caused by an iritis with extensive posterior synechia. The right eye had been subjected to an unsuccessful operation which left the iris drawn into the corneal wound. Iridectomy being done on the right eye, the left immediately began to improve and regained $V=20/70$.

IRIDECTOMY FOR GLAUCOMA.—The permanence of the beneficial results of iridectomy has been investigated by Wygodski. His immediate results in 458 cases were favorable in all cases of acute inflammatory glaucoma, in 49 per cent of chronic cases, and in 90 per cent of the cases of simple glaucoma. With these figures he compares the conditions found two years or more after operation. Among 37 cases of acute glaucoma, he finds 76 per cent remained improved; 5 per cent unchanged; 11 per cent had deteriorated; and 8 per cent had become blind. Of 147 cases of chronic inflammatory glaucoma, 10 per cent still showed improvement; 40 per cent were no worse; 30 per cent had deteriorated; and 20 per cent were blind. In 129 cases of simple glaucoma, 1 case remained improved; 16 per cent continued stationary; 48 per cent had grown worse; and 35 per cent were entirely blind. Such statistics by no means show the full value of iridectomy, because many of the cases which continued to grow worse after operation grew worse more slowly; and without operation there certainly would have been none that improved, and but very few that remained stationary.

Fiske, reporting a series of 35 cases, advocates "early iridectomy in all cases of glaucoma; this iridectomy to be followed by a second or third, if necessary, immediately the symptoms return." It should be noted, too, that the iridectomy he urges is one removing a large section of iris, and reaching its root so far as possible.

THE CYSTOID SCAR.—Herbert, in discussing fistula formation in the treatment of glaucoma, admits that an eye cured by typical iridectomy is better than one with a filtering cicatrix. But where iridectomy fails something more is desir-

able, and to meet these cases he had tried to secure a fistulous cicatrix by a prolapse of the iris into the wound, but thoroughly covered by conjunctiva. In discussing Herbert's paper, Priestley Smith suggested three ways in which a sub-conjunctival fistula might be established, viz: by inclusion of conjunctival tissue in the sclero-corneal wound; by inclusion of iris tissue; and by failure of the wound to unite, without any foreign material in it. Collins pointed out that there were many cases on record in which a cystoid scar becoming involved in conjunctival inflammation, led to panophthalmitis. He had also seen a case of sympathetic ophthalmitis from such a scar. Such an operation he thought should be limited to cases in which the other eye was worthless or had been removed. Sir Anderson Critchett had seen the benefit of the cystoid cicatrix, but thought to deliberately endeavor to procure it, a dangerous proceeding.

DETACHMENT OF THE CHOROID.—Axenfeld, reporting a case in which this occurred, points out that it is attended with diminution of the intraocular tension; that it is probably more common than is usually supposed; and that occurring after iridectomy it may be distinctly beneficial, as it usually leaves no permanent bad effects.

SYMPATHECTOMY.—Excision of the superior cervical sympathetic ganglion for glaucoma is an operation not yet discarded, and probably not to be discarded for a limited class of cases. But the enthusiasm regarding it is notably on the wane. Lagrange reports two cases without any notable benefit. Komoto, in an experience of ten cases, found the intraocular tension was not reduced to any noteworthy degree. Hansell reports a case in which bilateral excision was of negative value. De Schweinitz finds that the effect of sympathectomy is apt to be temporary. Wilder, who reports seven of his own and brings together 68 American cases, concludes in the main that sympathectomy is not an operation to be condemned too hastily, and he gives it the preference for simple glaucoma.

In Wilder's statistics, however, it is notable that both

cases of *hemorrhagic glaucoma* were improved by the operation. In Rohmer's statistics, published a year before, the same thing is to be observed. All the hemorrhagic cases, 5, were improved. In view of 100 per cent improvement in 7 cases and of the dangers of iridectomy in this form of glaucoma, we might think of sympathectomy as the operation of choice for this particular class of cases.

For all other cases I believe that iridectomy should be done first; unless one eye has been lost, and the patient refuses to have his remaining eye subjected to the direct risk of an operation upon it. Sometimes it will be proper to do sympathectomy after iridectomy. This is safer than to reverse the order. De Schweinitz points out that sympathectomy may cause increased vascularization of the eye ground, and perhaps hemorrhages; and in one of Wilder's cases, where sympathectomy had previously been done, iridectomy was attended with disastrous intraocular hemorrhages, forcing out the lens and vitreous.

Lacrimal Apparatus

SECRETION OF TEARS.—This has been carefully studied under normal and abnormal conditions by Schirmer. He finds that with a normal conjunctiva the amount of tears produced by a healthy lacrimal gland is only what is needful for keeping moist the surface of the cornea and conjunctival sac. This is about 0.5 to 0.75 grammes to the sixteen working hours. But under psychic or reflex irritation the lacrimal gland is capable of greatly increased secretion. During such hypersecretion the lacrimal gland itself remains normal. The abnormal condition involves rather the center governing secretion. After extirpation of the lacrimal sac, the gland does not atrophy, but retains its full capacity for secreting tears. The cessation of the epiphora is due to removal of the irritation caused by chronic inflammation of the tear sac and conjunctiva.

EPIPHORA DUE TO HYPERSECRETION is too often ascribed to lacrimal obstruction. Without positive evidences of abnormal accumulation in the lacrimal sac, obstruction should scarcely be considered as a possibility. Berger reports four cases of epiphora occurring as the initial symptom of Basedow's disease, exophthalmic goiter. Two of the patients had been subjected to the torture of the lacrimal probe, of course without benefit. Such epiphora may be due to the imperfect action of the lids. But in Berger's cases it long preceded such imperfect lid movements; and he has seen it persist after exophthalmos and the disturbances of lid movements have long passed away. The tearing is noticed at special times, being excited by the usual stimuli. It is probably due to nerve disturbance. A similar explanation may be given for the diminution of the lacrimal secretion, which is more common in exophthalmic goiter. For the hypersecretion Berger suggests the local use of cocain and the internal administration of atropin. For deficient secretion he has employed instillations of salt solution, repeated several times a day.

ACUTE DACRYO-ADENITIS.—In strong contrast to the extreme rarity usually ascribed to the disease, Inman reports ten cases treated as house patients in the Royal London Ophthalmic Hospital within two years. He recognizes two groups of cases; one associated with mumps, usually bilateral, in which suppuration does not occur. The other not connected with mumps, commonly unilateral, and in which suppuration may or may not occur. He reports but a single case associated with mumps; and, curiously, in this case the disease was unilateral, and the lacrimal gland suppurated, although the salivary glands did not. He mentions another case of suppuration occurring after measles. In two of his cases there was impetigo of the nostrils and blepharitis; and in two of them subsequently phlyctenular conjunctivitis and pustular blepharitis. The lacrimal sac was healthy in all cases.

The attack begins with stiffness, pain and redness in the

outer part of the upper lid, the symptoms increasing rapidly for 2 or 3 days. There is marked edema of the ocular conjunctiva to the outer side, with a little catarrhal discharge. The skin of the lid becomes stretched and brawny, and it is impossible to raise the lid voluntarily. Movements of the eye-ball, however, are comparatively free in all directions. The general symptoms and rise of temperature are very slight. In only one case, the one complicating mumps, did the temperature rise to 100° F.

In no case did suppuration extend beyond the gland. In one it was limited to the accessory gland in the lid. In the others the lid and orbital portions seemed matted together. By palpation under general anesthesia the limits of the swelling can be distinctly outlined, except that it extends backward out of reach when the orbital gland is involved. Whenever abscess formed the tendency was to point into the conjunctival sac, and not through the skin of the lids. When the abscess opened spontaneously a thick purulent discharge issued from the conjunctival sac, and there was marked improvement in the pain and swelling.

From orbital cellulitis acute dacryoadenitis is distinguished by the localization of the tumor in the outer half of the upper lid, the slight pyrexia and general symptoms, and the usual absence of exophthalmos. The more chronic cases might be mistaken for orbital periostitis. But these may be distinguished by the detection of a groove between the orbital margin and the tumor.

The local treatment consists of hot fomentations and, when required, the opening of the abscess through the conjunctiva. In none of Inman's cases could any permanent alteration of the parts be detected. Nor was there either at the time or subsequently any serious interference with the lacrimal function. If, as seems probable, the gland tissue was extensively destroyed the conjunctival secretion proved sufficient to serve the purpose, just as it does after extirpation of the gland.

DACRYOPS AND FISTULA OF GLAND.—Cystic dilatation of the ducts of the lacrimal gland can generally be accounted for by previous inflammation causing obstruction; but in a series of cases reported by zur Nedden there was one in which a cause could not be discovered. For the cyst excision of a large part of its wall, giving free drainage from the gland into the conjunctival sac, may give relief. But if a fistula exists, opening upon the skin surface and



Fig. 35.—Traumatic Dislocation of the Lacrimal Gland.

causing sufficient annoyance, excision of the lacrimal gland is the only thing that promises much benefit.

CALCAREOUS CONCRETIONS OF THE LACRIMAL GLAND.—A gland excised after extirpation of the lacrimal sac was studied microscopically by Levi. The concretions were found occupying the lumen of the excretory ducts. The sections of them measured from 0.5 to 1.4 mm. across. They consisted of concentric, granular, chalky masses. Such concretions usually indicate a long continued pathologic process in the gland. On the other hand, they may become a source of irritation, causing a persistent reflex epiphora which only the enucleation of the gland will remove.

DISLOCATION OF THE LACRIMAL GLAND BY TRAUMATISM is a rare accident; and Villard thinks it has only been observed in young children. He reports its occurrence in a boy 8 years old, and collects 5 previously reported cases. The injury is by a fall upon some sharp edge, which usually inflicts a wound of the upper lid through which the gland may prolapse. Disinfection of the wound, return of the gland to its normal position, and closure of the wound by sutures, is the treatment to be preferred. But in other cases the removal of the gland is necessary, if the injury be such as to cause chronic suppurative inflammation and fistula. The injury is not entirely confined to children, since I have recently encountered it in a man aged 45. But in this case the gland was probably pulled out of its normal position by a stick that impaled it. (See Fig. 35.)

REMOVAL OF TEARS.—The removal of tears from the conjunctival sac to the nose is thoroughly discussed by Schirmer. He considers the views that have previously been put forward on the subject under the headings of: the siphon theory; capillary attraction; aspiration into the nose; the sac compression theory; the sac dilatation theory; and the lid closure theory. These different views he has endeavored to test by observation and experiment. He concludes: That in the act of winking, the tension upon the ligament at the internal canthus, causes a dilatation of the sac, which sucks in the fluid tears from the conjunctiva, rather than the thick mucus at the nasal opening at the duct. The sac being thus distended, its own elasticity and the pressure of surrounding tissues force out the contents, which escape through the broader lacrimal duct into the nose, rather than through the narrow canaliculi to the conjunctiva. Capillary attraction, gravitation, aspiration from the nose, and pressure by lid closure, play no essential part in the removal of the tears. The importance of elasticity of the sac in securing the removal of tears is well supported by Halben's observations regarding the abundant supply of elastic tissue to the walls of the canaliculi and lacrimal sac.

Such being the mechanism for the removal of the tears, the importance of preserving the function of the sac by avoiding any dilatation of the canaliculi, if possible, is obvious. Epiphora without marked accumulation of fluid in the sac should also prompt us to a careful study of the lid movements, since some defect in them may be the essential cause of the trouble.

EPIPHORA OF INFANTS is clearly due to obstruction; but the obstruction is at first not pathologic, being due to delayed development of the lacrimal passages. It should, therefore, be treated very differently from obstruction in the adult. Heinemann points out that the accumulated material is generally purulent and contains organisms which endanger the cornea should it become abraded. Therefore, these cases should be watched and treated. Cutler urges treatment for the same reason. While he thinks it probable that the septum between the lacrimal passages and the nose would, in time, perforate spontaneously, he has often resorted to a slight incision of the punctum, the passage of a number 3 or 4 Bowman probe, and repeated irrigation through a long canula. He relies chiefly on the irrigation, regarding it as more gentle and effective than the deep introduction of a probe.

DACRYOCYSTITIS.—There are many things beside closure of the duct that may cause epiphora, and all should be carefully considered before proceeding to radical operative measures. The reflex irritation and swelling of dacryocystitis may cause it without any organic stricture. Clark reports a brilliant cure from injecting the sac with a solution of chlorid of zinc. He has used a 20 per cent solution, but does not advise one stronger than 5 or 10 per cent.

EXTIRPATION OF THE LACRIMAL SAC.—This operation continues to be more widely practised. No doubt there exists quite a field for it; not only among cases in which the persistent use of large probes fails to give relief, but also among those in whom the pain caused by probing prevents the carrying out of this line of treatment. Rollet, from an

experience of twenty-seven cases followed from six months to six years after operation, finds that it ends the dacryocystitis; and usually it stops the epiphora, or at least changes its character so that it is less annoying. In 18 cases epiphora ceased entirely; in 2, was insignificant; in 1, was intermittent; in 3 it appeared only on exposure to cold or wind; while in 3 it persisted. He reports two failures: in one there remained a minute fistula, but the patient was quite satisfied with the result; in the other case a small pouch re-formed later.

It is possible that these failures arose from incomplete removal of the sac, since Rollet attempts to accomplish this by the use of a sharp curette. De Lapersonne, after dissecting out the sac as well as may be, employs the galvano-cautery to destroy any remaining islets of mucous membrane. Axenfeld again urges the value of his method of dissecting out the sac.

In opening the discussion of this subject before the Section of the New York Academy of Medicine, Arnold Knapp recognized as indications for the operation: Chronic purulent dacryocystitis not to be cured by other treatment; repeated attacks of dacryocystitis with abscess; dilatation of the sac; and lacrimal fistula. Local anesthesia may be used in the absence of acute inflammation. Otherwise general anesthesia must be resorted to.

The incision extends from the internal canthal ligament, down and out along the orbital margin, 15 to 20 mm. If the ligament be divided the parts must be carefully joined at the close of the operation. The sac is recognized by its pale red or bluish red, smooth, uniform surface. It is separated on the nasal side and above by blunt dissection, and outward by cutting with small blunt scissors. It is divided as low as possible in the lacrimal canal, and the canal thoroughly curetted with a small spoon. Remaining islets of mucous membrane, granulations, inflamed periosteum or carious bone must be carefully looked for and treated. Diseased bone should be removed if necessary, making an opening

into the nose. The edges of the wound are approximated and the cavity obliterated by pressure. Primary union and a practically invisible scar were secured in most of Knapp's cases; and in all, the subsequent lacrimation was so slight as to require no treatment. The removal of the underlying periosteum with the sac is preferred by Snydacker, because by this method the entire sac is certainly removed.

POLYPUS OF THE CANALICULUS.—In a case of epiphora Ayres found, on slitting the canaliculus, a polypus which seemed to spring from near the junction of the canaliculus and sac. The removal of this little growth entirely relieved the epiphora.

FISTULA OF THE LACRIMAL SAC is very rarely regarded as a congenital anomaly. Yet it may be of such origin more frequently than is supposed. Harman reports two cases in children under 5 years of age, in which there had been no inflammation and no discharge, but the mother of one of these children had a similar condition which had not attracted attention until she was 7 years old, when it became inflamed, without inflammation or other disease of the lacrimal passages.

TUBERCULOSIS OF THE LACRIMAL SAC.—This condition may readily be overlooked, since it can present all the usual symptoms of dacryocystitis. In 46 extirpations of the sac, Rollet encountered it four times. In these cases, although inoculation of the guinea pig demonstrated the presence of the bacillus, and there were evidences of tuberculosis elsewhere, the local disease appeared to be permanently cured by the operation.

LACRIMAL DISEASE IN THE NEGRO.—Santos-Fernandez calls attention to the greater diameter, directness and shorter course of the lacrimal passages in the negro, as demonstrated by the anatomic studies of Presno. To these anatomic peculiarities he ascribes the comparative freedom from lacrimal disease exhibited by the colored race. Among 37,290 patients, he encountered 773 cases of disease of the lacrimal passages. Among the whites the proportion of lacrimal cases was 60 in 10,000; among negroes, 1 in 10,000.

Diseases of the Lids

SPASMS AND TICS OF THE LIDS.—Meige undertakes to classify these. He defines spasm as a motor reaction resulting from an actual irritation through a spinal or medullary-spinal reflex tract. A tic is a psycho-motor difficulty. The latter is of cortical origin—a functional movement, but exaggerated and inopportune.

The tics of the lids are to be distinguished from blepharospasm. Meige recognizes the following: In the tic of *winking* the movements are more frequent and forcible than those of normal winking. In the tic of *clignement* there is partial closure of the lids with pressure upon the eye-ball. The tic of *lid retraction* is the opposite of the preceding, the eyes being opened especially wide. Meige also recognizes *tics of the eye-ball*, both of the extraocular and intraocular muscles.

The treatment he suggests is methodical training in the movements involved, and in abstaining from movement—"training in immobility"—during periods progressively lengthened. This training may be carried on before a mirror. Persistent attention to the matter is required. But in young persons the improvement may be very rapid. In older patients the progress is less favorable. Still Meige mentions the cure of a tic of three years' standing in a woman of 68.

SPASMODIC RETRACTION OF THE UPPER LID.—Two cases of this kind are reported by Chevallereau and Chaillous. In a woman aged 42, the condition was bilateral, had lasted six months and continued several weeks unchanged while under observation. On looking down the upper lid remained unmoved, exposing a large part of the sclera and the cornea. On attempting to close the eyes the upper lids yielded very slowly to the action of the orbicularis. There were no other symptoms of exophthalmic goiter and none of hysteria. In the second case there was retraction of the upper lid of

the left eye only, also associated with failure of the lid to follow the downward movements of the globe. The patient, a man aged 46, stated that the condition had existed from birth.

SWELLING OF THE LIDS.—Lid edema arises from very many causes. An unusual one is tertiary syphilis. Neese reports a case from this cause affecting only the upper lid of the right eye. The nature of the disease was at first unrecognized, but the occurrence of other lesions led to mercurial treatment and complete removal of the swelling.

BLEPHARITIS.—It would lead to better therapeutic results if we habitually recognized as distinct the various conditions commonly grouped under this head. Terson proposes a dermatologic classification of marginal blepharitis. He calls attention to the importance of microscopic examinations, and recognizes a general division into the suppurative and squamous varieties. Dealing with the suppurative cases distinguished as pustulous blepharitis, Fridenberg calls attention to the value of pressing out the accumulations from the lid margin. Such accumulations, through the pathogenic bacteria they contain, he believes are quite capable of inoculating the abraded or even the sound cornea, and causing phlyctenules. He cites two cases long under other treatment without material improvement, in which thorough expression, massage and disinfection of the lid margins brought about a speedy cure.

Reynolds makes a thorough application of carbolic acid to the lid margins. About a drachm of the crystallized acid is dissolved by the addition of 10 minims of alcohol. In the cases with dry, red, slightly thickened lid margins, thin lashes and minute scales between them, he dips a needle into the carbolic acid, and with it scrapes off all the detachable scales. The whole surface among the lashes is left whitened; and about the fifth day it exfoliates. The application is to be repeated about once in ten days. He states it is followed by a luxurious growth of lashes. The same sort of application is to be made when the edge of the lid is ex-

coriated; or after the removal of the thick crusts by rubbing with a cotton mop dipped in petrolatum. For cleansing the lid margin of scales, Wolfberg has employed benzine. This is thoroughly rubbed into the base of the lashes while the lids are closed and their margins slightly everted. Hydrogen dioxid he has also found valuable for this purpose. It serves to loosen and render visible scales previously imperceptible. After such cleansing the yellow oxid ointment is to be used.

XANTHELASMA.—Electrolysis is claimed by Villard and Bosc to be the best treatment for this condition, giving permanent and complete removal of the deformity, without loss of tissue. After infiltration anesthesia, two needles are inserted parallel to the surface of the skin, in opposite borders of the discolored patch, to a length of not more than 10 mm. The current is then gradually turned on to a maximum of 8 milliamperes. After 2 to 4 minutes the current is gradually turned off. For smaller patches a single needle may be employed, attached to the cathode; the anode being a metal plate moistened and held in the patient's hand.

ENTROPION.—For spasmodic entropion complicating inflammation about the eye, Buchanan takes a half curved needle, with a double silk suture 8 inches long; inserts it through the skin of the lower lid 5 mm. from the ciliary margin, at the junction of the external and middle thirds of the lid; carries it under the skin parallel to the lid margin; and brings it out by a counter puncture at the junction of the inner and middle thirds. The needle is then re-inserted 3 or 4 mm. below the counter puncture, carried parallel to the first course, and brought out below the first puncture; the ends of the thread are then crossed, drawn quite tight, tied and cut short. The lid is at once everted, and the irritation caused produces a mass of inflammatory tissue perpendicular to the lid margin, which acts as a splint, and keeps the lid rigid. The longer the stitch is left in the greater the reaction. And the fibro-plastic tissue lasts for a week or two after the stitch is removed. It becomes completely absorbed, and no permanent deformity results.

Gifford relies almost entirely upon the Van Milligan operation, of splitting the margin of the lid and introducing a strip of lip membrane. To make the incision in the lid margin gap widely enough, he uses 3 or 4 sutures introduced first through the margin of the lid, immediately external to the incision, then through a narrow fold of loose skin about 5 mm. from the lashes. A firm roll of moistened absorbent cotton 3 mm. in diameter is then placed under the free portion of the sutures, so that when they are tightened the roll presses on the tarsus and the lid margin is elevated,



Fig. 36.

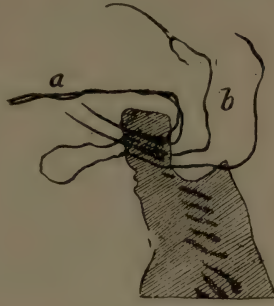


Fig. 37.

Ewing's Operation for Entropion of Lower Lid.

rather than the lid as a whole. The lip flap should be as long as the lid margin, and 3 mm. wide. The common mistakes are, making the incision too short, and not getting it to gap widely enough.

For *entropion of the lower lid* Ewing has perfected this operation: The lid being everted with a modified Desmarres forceps, an incision is made parallel to the lid margin and 2 or 2.5 mm. behind it, extending the whole length of the lid, entirely through the tarsal tissue but not through the skin of the lid. This is shown in Fig. 36. Then a temporary suture *a* (Fig. 37) is introduced and drawn upon to pull the incision widely open. Then the suture *b* (Fig. 37) is introduced, first through the conjunctival edge of the cut, then through the bottom of the wound to the skin surface a very little below the cilia. Next it is carried along on

the skin 3 mm., parallel to the lid margin, then passed back through the bottom of the incision, drawn moderately tight, and tied in the incision. For the sutures fine needles and No. 1 silk are used. The eye should be bandaged, and cleansed daily with 1:5000 sublimate solution; and the sutures removed after 3 to 5 days. The gap thus made in the inner surface of the lid fills in with new tissue after a time, and a permanent restoration of the lashes to their normal position is secured.



Fig. 38.—Hotz Incisions for Ectropion of Lower Lid.

CICATRICAL ECTROPION.—In plastic operations for this condition, Hotz finds that success depends on:

- (1) Proper division and fixation of skin flaps.
- (2) Choice of suitable material for covering the lids.
- (3) Shortening of the over-stretched lid border.

He holds: (1) That all flaps should be liberal and should cover the adjoining exposed area. The lid flap should be firmly sutured to the margins of the tarsus of the upper lid; and to the free tarsal margin and the tarso-orbital fascia for the lower lid. The upper lid should then be drawn well down and fixed by two sutures passed through the free margin and fastened to the cheek by adhesive plaster. Or the lower lid should be similarly drawn up by sutures fixed on

the brow (see Fig. 39). The exposed areas are covered by flaps that overlap the skin edges and need not be fixed by sutures.

(2) The only materials fitted to replace the skin of the lids are the thin skin which covers a scar or the Thiersch graft.

(3) The reposition of the lower lid cannot be perfect or permanent without compensating for its elongation through stretching by excising a portion of appropriate length ad-

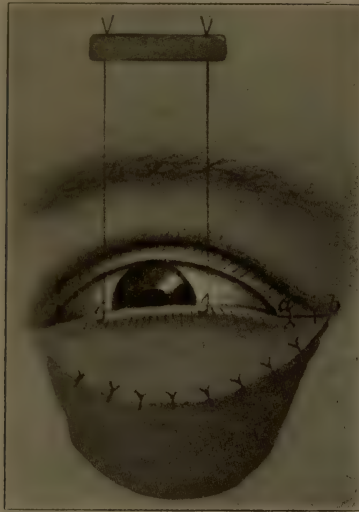


Fig. 39.—Hotz Operation for Ectropion of Lower Lid After Suturing Lid.

joining the outer canthus. His manner of dealing with ectropion of the lower lid is shown in Figs. 38 and 39. The piece *a b c d* (Fig. 38) is excised; and the dark area of Fig. 39 is covered with a Thiersch graft.

PTOSIS.—*Atonic ptosis*, the form due to separation of the skin of the lid from its normal attachments to the deeper tissues, may be caused by injury. Alleman reports the case of a school boy who struck the outer angle of the left eye against a window frame. No swelling or discoloration fol-

lowed. But he noticed almost immediately that the skin of the upper lid drooped, and falling below the lid margin seriously interfered with vision and produced an unsightly deformity. Alleman corrected the difficulty by fastening the skin to the underlying tissue with three sutures, and later removing a strip of redundant skin.

In a case of Mules *operation to relieve ptosis* by connecting the lid with the frontalis muscle by a silver wire, Worth found that the knot worked to the surface and the wire had to be removed. He has therefore used instead a piece of Kangaroo tendon, which, although somewhat difficult to pre-

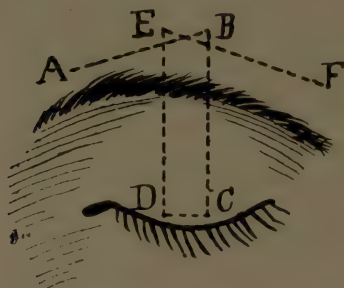


Fig. 40.—Harman's Operation for Ptosis.

pare, he hopes will give a permanent result. Harman suggests, instead of silver wire, the use of the fine woven chain of gold sometimes used as an eyeglass cord. This can be perfectly sterilized by boiling, is very flexible, will become permeated by connective tissue and incorporated with it, and requires no knot at the end that will be liable to work to the surface. It is introduced by fastening it to a 4-inch needle with a triangular point. This is entered at *A* (Fig. 40) and brought out at *B*, again entered at *B* and brought out at *C*, and in the same way carried beneath the surface from *C* to *D*, *D* to *E*, and *E* to *F*. By traction on the free ends at *A* and *F* the lid can be raised to any desired extent, and this adjustment can be left to the day following the introduction of the chain. In a week or so the new tissue will have so surrounded and permeated the chain that it can no

longer be displaced. The free ends can then be shortened and buried in the tissue at *A* and *F*.

Allport has improved the Panas operation by cutting out the triangular pieces of redundant skin *a, a, a, a*, and thinning the remaining flaps *b, b* (Fig. 41), and introducing the sutures shown so as to secure exact coaptation and avoid puckering. He also scarifies the tongue flap *T* that is to be drawn up under the brow, to get better union. He admits there is a thick lumpy appearance of the bridge of tissue, which never entirely disappears.

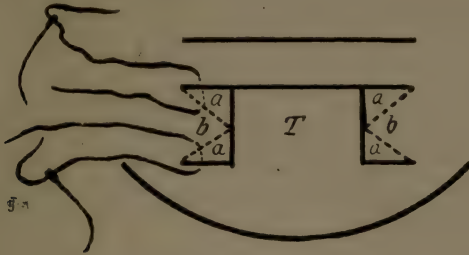


Fig. 41.—Allport's Operation for Ptosis.

However, the great objection to the ptosis operation of Panas is that it destroys the normal sulcus below the brow. To connect the lid with the frontalis without creating this deformity is the object of an operation proposed by Sour-dille. The brow is shaved, and a curved incision, convex upward, is made down to the bone; the flap being dissected up sufficiently to allow good access to the orbit. The orbit is then entered by dividing the fascia along the orbital margin. The tendon of the levator is raised and two sutures passed through it; each in the form of an X, to give a good hold, one placed near each lateral margin of the tendon. The tendon is then cut off behind the sutures. The tissues of the brow are undermined from the incision upward, and the sutures carried through the frontalis tendon and each tied over a little roll of gauze. The tendon of the levator is thus brought in close relation with the frontalis tendon, being sufficiently drawn upon to secure the desired elevation of

the lid. The sutures are allowed to remain seven or eight days. This operation, if equally effective and permanent in its result, will be a distinct advance over that of Panas. It depends, however, upon the frontalis muscle for the voluntary control of the lid.

Ensor reports a case of unilateral congenital ptosis in which the wrinkling of the brow on one side to effect the elevation of the lid through the frontalis, constituted a large part of the deformity complained of. In operating on it, along with the excision of the tissue from the lid to diminish its drooping, he employed the Paquelin cautery to bind down the tissue to the supraorbital ridge and orbital margin by a firm cicatrix; hoping thus to prevent the wrinkling of the brow and to create a groove beneath it.

In cases of ptosis, the power of the levator muscle may be tested by placing the hand on the brow to exclude the action of the frontalis, and observing whether the lid can still be raised. If there is some power in the levator, de Lapersonne does a sort of advancement of the levator tendon. An incision through the skin and obicularis is made parallel with the lid border, 4 or 5 mm. above it. The tendon of the levator thus exposed is isolated by an incision along each margin, and raised on a strabismus hook. A suture is passed through each edge of the tendon above the hook, the tendon is divided and the suture passed through the tarsus, 3 or 4 mm. above the lid margin. The tendon thus advanced should attach itself firmly to the tarsus. With this advancement a piece of skin may be excised before closing the superficial wound with sutures.

The proposers of these various operations have most of them seen fit to make some unfavorable reference to the operation of Motais, especially to its difficulty. Motais' operation is not applicable to all cases of ptosis; but for the class to which it is suited, it is the ideal operation and will be more generally practised in the future.

Diseases of the Orbit

THE POSITION OF THE EYE-BALL.—An elaborate instrument for determining this has been devised by Ambialet. Adjustable arms are brought in contact with the upper and lower margins of the orbit, and the observed eye is fixed by looking in a mirror. With it the horizontal position of the eye-ball may be determined as well as any asymmetry in the orbit. For measuring the degree of exophthalmos, however, the simple scale, or *proptometer*, which I have proposed is sufficiently accurate for any clinical use. It is shown in Fig. 42. The zero edge is pressed firmly against the outer mar-

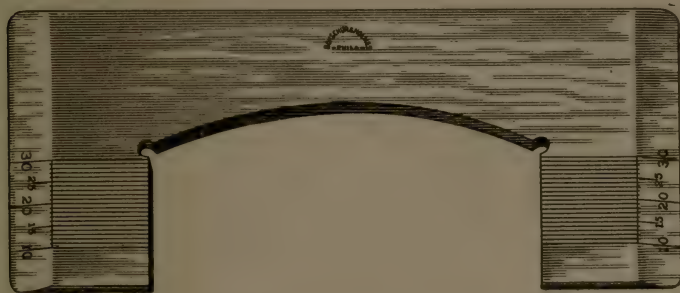


Fig. 42.—Proptometer for Measuring the Prominence of the Eye-Ball.

gin of each orbit; and sighting along the ruled lines we observe opposite which one the apex of the cornea is seen.

The normal variability in the position of the globe is worthy of more careful study than has been given to it. Ludwig has demonstrated the voluntary protrusion of the eye-ball accompanying wide opening of the eye, by use of a photographic camera held in fixed relation with the head. With the widening of the palpebral opening from 10 to 14.8 mm. there occurred a protrusion of the eye equal to 0.85 mm.

CELLULITIS.—Two cases of orbital cellulitis occurring as a sequel of scarlet fever are reported by Chance. Both patients were boys, aged 10 and 17 years. There was great

protrusion of the eye-ball and chemosis. Incisions into the orbit failed to reveal any focus of suppuration. There was swelling and intense congestion of the optic disks, and in one case retinal hemorrhages; but there was no evidence of an infectious process within the eye. Both patients died at the end of a week. Thrombosis, probably involving the cavernous sinus, seems the most plausible explanation.

Although Bull does not think *subconjunctival injections* of positive value in other conditions, in several cases of orbital cellulitis, he has found that subconjunctival injections of a sublimate solution (1-1000) exerted a very favorable and unusually rapid effect in hastening the suppurative stage, in reducing the dense infiltration of the orbital cellular tissue, and thus aiding in restoring the circulation to the strangulated parts.

PULSATING EXOPHTHALMOS.—Cases cured by ligation of the common carotid artery, with retention of good vision and no serious complications, are reported by Wurdemann and Bull. In Wurdemann's patient the condition seemed to have arisen spontaneously, a "sudden snap in her head" being felt while she was in a constrained position; and immediately followed by dizziness and vomiting, and later the bruit, protrusion of the eye, headache and other symptoms of this condition, which had continued for one year. Bull's patient was rendered unconscious by a blow on the head. The next morning he noticed the roaring noise, and on the second day protrusion of the eye and swelling of the lids. He was first seen a month later when the enormous distension of the retinal and conjunctival veins was a striking feature of the case. Apparently both cases were typical examples of the spontaneous and traumatic forms of rupture of the carotid into the cavernous sinus, or other form of arterio-venous aneurism.

RECURRING HEMORRHAGE.—Petit reports two cases in which this condition first called attention to vascular and renal disease. It was attended with headache, exophthalmos, and later discoloration of the lids. The movements

of the eye were somewhat limited or painful. With the absorption of the hematoma the protrusion disappeared and vision remained normal.

HYDATID CYST.—Cabaut bases his monograph upon 35 cases observed at Buenos Ayres among 165,000 patients suffering from eye diseases. Of these 21 occurred in males, and in 2 the sex was not specified. This corresponds fairly with the proportion observed in 75 previously reported cases. The patients varied in age from 2 to 55 years, the larger number of them being about the age of 20. The age of the patients seems closely related to their occupation. Nearly all came from the country, where they were engaged in watching flocks, in close contact with dogs. In 24 cases a preceding blow upon the eye was mentioned; and Cabaut attaches some importance to such traumatism.

The cysts varied in size from that of a hazel nut to that of a fist, the larger number being the size of a walnut. Pain was complained of invariably and was an important symptom. Diplopia was generally noticed, the variety depending upon the muscles interfered with in the particular case. The cyst was situated in the upper and outer regions of the orbit rather more frequently than elsewhere.

Exophthalmos was present except when the cyst was very small and superficial. Mydriasis and paralysis of the accommodation due to pressure on the ciliary ganglion were noted in the majority of cases. Marked chemosis sometimes existed. The duration of the case varied from one month to seven years. The disease sometimes caused blindness by pressure on the optic nerve or disorganization of the eye-ball. It rarely ended in death by penetration of the cranial cavity and suppuration.

The treatment is excision of the sac. This should always be preceded by puncture with a hypodermic syringe, to make certain the diagnosis between this condition and meningocele. But such puncture should be immediately followed by operation in cases of hydatid cyst; because of the inflammation that is likely to be set up by the cyst fluid escaping through the puncture.

Tumors

METASTATIC CARCINOMA.—Metastatic carcinoma, usually described as of the choroid, starts as an infiltration between the choroid and sclera, and extends to both these coats, the retina and the optic nerve. It starts in the posterior portion of the eye-ball, usually to the temporal side of the optic nerve. It promptly causes impairment of vision, and it can early be studied with the ophthalmoscope. This is of practical importance because the nature of the growth can thus be recognized. Such recognition may first call attention to the fact that the patient is suffering from carcinoma; and upon the differential diagnosis between this condition and sarcoma of the choroid may rest the decision as to the necessity for immediate enucleation. Within the year new cases were reported by J. H. Parsons, E. L. Oatman and F. Krukenberg, who each give a summary of previously reported cases. Each includes some cases which have been overlooked by the others; but combining their work, it appears that 41 are now on record.

Carcinoma in this situation is always metastatic; but in at least seven cases the primary growth had not been recognized, and the patient was believed to be in good health when the eye became involved. In 27 cases the primary growth was situated in the breast. Probably on this account the condition is much more common in women. The two eyes were affected with almost equal frequency, right 22, left 24. In ten cases both eyes were involved.

In all cases the growth is broad in comparison with its thickness. It is flat, with a thin edge; and in the early stages appears not to be raised above the level of the surrounding fundus. It may at first be mistaken for a patch of choroiditis. Vision is lost in from two weeks to two months after the appearance of eye symptoms. In a majority of cases the tension of the eyeball has not been increased; but, as Oatman points out, this may be due to the early fatal term-

ination of the cases. The average duration of life after involvement of the eye, is 6 months; and in no case has the patient survived 2 years.

The important differential diagnosis lies chiefly between carcinoma and sarcoma, and as summarized by Oatman rests upon the following points:

CARCINOMA.

SARCOMA.

Always secondary.	Secondary is unknown.
Always occurred posteriorly.	May occur at any point.
A flat discoid tumor which spreads laterally.	A rounded protuberance into the vitreous.
Has not appeared vascular.	May appear vascular.
Early detachment of the retina.	Late detachment, when centrally located.
Destroys vision in a few weeks.	May exist for a long time with good vision.
May be very painful with T. N. or T.—	Pain is due to T.+
T. May be diminished.	Not diminished.

Such differential diagnosis is important because, for sarcoma, the eye-ball should be removed as soon as possible. But for carcinoma, although enucleation is the only sure method for relieving ocular pain, it will not lengthen life. Neither will it prevent the involvement of the second eye, which in two cases occurred after enucleation of the eye first affected had been done.

GLIOMA OF THE RETINA.—The *diagnosis between glioma* and the various conditions grouped as *pseudo-glioma* will always present some difficulty. Jessop reports a case at first regarded as uveitis with hypopyon, which subsequently proved to be glioma. There was some history of trauma, dislocation of the iris, lens opacity, and a small quantity of milky white fluid in the lower part of the anterior chamber. The tension was normal and vision reduced to light perception. The "hypopyon" was drawn off, and recurred; sometimes disappeared spontaneously, and reappeared. When

the case had been three weeks under observation a decided increase of tension was noted. On examination glioma was found extending into the optic nerve. The contents of the orbit were removed, but the boy died a few months later of brain involvement. The material in the anterior chamber proved to be glioma cells.

Parsons and Flemming report a case in which the gray-white reflex and vessels just behind the lens, caused a supposition that the eye contained a glioma. After enucleation the condition was found to be one of persistent hyaloid artery. Fejer reports a case in which Fuchs was inclined to the diagnosis of glioma, altho he did not feel absolutely certain, and advised delay. The subsequent history showed that it was not glioma.

Fejer holds that errors in the diagnosis of glioma cannot be avoided. Yet the importance of early diagnosis is again illustrated in Holmes' cases. He reports six eyes removed for glioma. Of the three operated on during the first stage, and one in the second stage, all were cured. But two cases operated on in the third stage were both fatal. With reference to the uncertainty of diagnosis, Holmes urges to take the side of safety—enucleate a blind eye even on a doubtful diagnosis. Knapp, in discussing Holmes' paper, brought up the safety of the surgeon. He had enucleated a glioma in an eye that still retained some vision. The boy was saved. But Knapp was sued for damages. He had to prove from the specimen that it was glioma, that the specimen was the eye of that patient, that he had obtained the consent of the parents, and that the disease was necessarily fatal without operation. Then the suit was dismissed. The risk of a suit for malpractice is an important practical consideration intimately interwoven with any question of enucleation.

SARCOMA.—The diagnosis between glioma and sarcoma is of little importance to the patient; but it may not be easy to make it. *Age* is an important factor. Bruner, however, reports a case of sarcoma of the choroid in a girl under six years of age; and de Lapersonne one in a child of four and

a half years. In the latter case the growth occurred in an eye that had been lost by ophthalmia neonatorum, and subsequently operated on for staphyloma. Harms also reports a case in which the eye was shrunk from a previous wound.

Situation.—Cases in which the sarcoma had developed adjoining the optic papilla are reported by Fehr, Lapersonne and Opin. In both cases the optic disk was quite covered and surrounded by the tumor. A ring sarcoma of the ciliary body is reported by Parsons; and one extending into the ciliary body from the iris by Rogeman. Derby reports an interesting case of an eye enucleated for a perforating ulcer of the cornea, in which a beginning melano-sarcoma of the ciliary body was found on microscopic examination.

Verhoeff and Loring give the details of a case in which the uveal tract was involved secondarily by extension inward of an epibulbar sarcoma, which started above the cornea.

A primary sarcoma of the cornea is reported by Sempe and Villard. The patient was a man of 65, who had first noticed the growth on his cornea 15 years before. It was still confined to the cornea and there was no recurrence 2 years after enucleation.

Coppez reports three cases of sarcoma of the *lacrimal gland*, all extirpated by entering the orbit by a Kronlein operation. In two there was no recurrence at the end of 5 and 3 years, respectively. In the third case the parotid gland of the same side was also involved. Both masses were removed, but the corresponding cervical glands were found involved 18 months later.

PAPILLOMA.—This usually affects the conjunctiva or the limbus. But Deane reports a growth which was wholly confined to the cornea: and on removal was proven by the microscope to be of this character. The case reported by Coover (see Fig. 43), had started from the temporal margin of the cornea 8 months after the removal of a supposed pterygium from that situation. It had entirely circled the

cornea, except 3 mm. of the upper nasal margin, and was rapidly extending upon the corneal surface. Johnston also reports a case starting in the scar of a pterygium, that had been twice removed from the usual situation at the nasal margin of the cornea; and another case also starting at the nasal margin.

In a case reported by Stephenson two large growths and

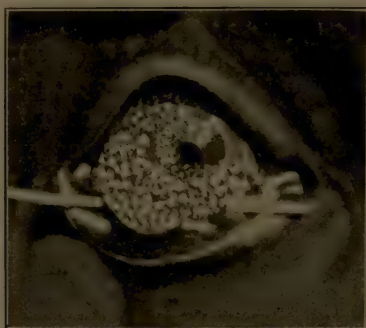


Fig. 43.—Coover's Case of Papilloma of Cornea and Conjunctiva.

several smaller ones were found to arise from the conjunctiva. A similar growth was found on the patient's hard palate. Morax and Manouelian report a case the size of a sou, protruding one-half centimetre from the inner canthus, which was said to have developed in 15 days.

Thorough removal, with cauterization of the base, is the proper treatment for such a growth. In all the above cases it was followed by no recurrence, except Stephenson's case, in which there had been repeated removals. But he did not know how complete these removals had been, or whether the base had been cauterized.

Injuries to the Eyeball

BRUISE WITH RUPTURE OF IRIS.—Levinsohn reports four cases, and discusses the mechanism of indirect rupture of the iris. He points out that changes in the iris margin, such as are seen following contusion of the eye, may be encountered where there has been no preceding injury. Rupture of the iris occurs most frequently at the ciliary margin, next at the pupillary margin, and least frequently in the intermediate zone. These lesions result from the flattening of the anterior chamber, and the pressure of the aqueous exerted equally in all directions.

It is easy to see how the periphery of the iris, the thinnest part and receiving the least support from the lens, should be ruptured by the pressure of the aqueous. But why the inner circle of the iris should be next liable to suffer is not so evident. Levinsohn believes that the change observed in the pupil depends chiefly on paralysis of the iris rather than on rupture. Usually there is a marked paralysis of the sphincter, and a less marked and transitory paralysis of the dilator. When eserine fails to contract the pupil, or even dilates it, the sphincter is still paralyzed, while the dilator has somewhat recovered its tone.

CONJUNCTIVAL IRRITATION BY MINE GASES.—From certain coal mines in Wyoming, Gilbert has seen many cases of a peculiar form of irritation, which is not associated with the presence of dust or other solid particles in the conjunctiva, but arises from exposure to mine gases and powder smoke. Among 100 cases of ocular disease and injury met in one year, seventy were of this character. In 18 one eye was chiefly affected, and in 52 it was bilateral.

There is increased lacrimation, great photophobia and intense hyperemia of the conjunctiva; but the cornea and iris appear normal. The condition is so painful that it often compels the miner to immediately quit work and seek relief. The duration of the trouble is one to three days. Some men

do not suffer from it, others have two or three attacks a month; and in some the recurrences have been so persistent that they have been advised to work in the other portions of the mine. Gilbert finds that the remedy is some preparation of suprarenal gland. He had used the solution of adrenalin chlorid 1:1000. This immediately whitens the congested eyeball, and relieves the pain. Some cases require but a single application; others need it two or three times a day for a day or two.

CORNEAL VESICATION BY POTASSIUM BICHROMATE.—Thomson reports the case of a workman who got a drop of the solution or crystal of potassium bichromate in his eye. The cornea took no stain with fluorescin, but the lower half of its surface appeared bulged forward in the form of an almost transparent bag, which could be made to change its shape on gentle pressure with the lid. There was considerable conjunctival hyperemia. A firm bandage could not be borne. An opaque edge appeared at the upper margin of the bulging, and gradually extended as the cornea resumed its normal shape. No breach of surface was discovered. By the 27th day the curvature seemed to be normal; altho there was still much irregular astigmia and persistent anes-thesia of the affected area.

BURNS OF THE CONJUNCTIVA.—To prevent symblepharon from a severe lime burn of the lower cul-de-sac, Snydacker has resorted to the use of lead plates. A smaller one was adjusted to the inner surface of the lid, and a larger one on the skin surface. Each of these plates had four holes. Through these holes, and through the intervening tissue of the lids, sutures were passed, tied moderately tight upon the outer plate, and the ends left hanging. To these ends a strip of gauze was attached. This was passed under the chin, up over the head, and so round and round, dusted with starch, and made into a starch bandage. In this way the lid was drawn well away from the eye-ball, and the inner plate forced down into the cul-de-sac. The plates used were about 1 mm. in thickness. But Snydacker advises that the inner plate be made thicker at the lower edge and thinner at the upper.

The lid was thus kept fixed for 11 days, the upper lid serving to fully protect the cornea. No symblepharon resulted. Snyder points out that by this method the lid is drawn away from the eye-ball and the folds of transition are fully spread out. In this way may be prevented the starting of those cicatricial bands which by their continued contraction cause deformity.

PERFORATING WOUNDS OF THE CRYSTALLINE LENS.—Three cases of wounds of the lens, followed by clearing up of the opacity, are reported by Fleming. A man, aged 39, came with a splinter of wood $\frac{1}{4}$ inch long and $\frac{1}{8}$ inch wide, sticking through his iris and lens. A woman of 30 had been struck in the eye with a carpet tack. The iris was torn across and a track was visible through the lens, which was beginning to swell. A woman aged 45 had been stuck with a hat pin.

Ultimately in all these cases a scar could be seen running back through the lens, which otherwise had entirely cleared up. The first case recovered vision of 20/30. In the others vision became normal. These cases appear to have been reported within six months after the injury, and there is a possibility that after clearing up in this manner, a traumatic cataract may still develop. On the other hand they may remain clear. The treatment followed was the local application of atropin; and the administration internally of 10 grains of potassium iodide every 4 hours. (See page 140.) It may be noted that in all cases the wound penetrated the periphery of the lens, probably leaving the nucleus uninjured.

A case of wound of the crystalline by a spine of a chestnut burr is reported by Zimmerman. The spine was extracted, and altho a small opacity remained, vision of 6/6 was retained eight years afterward.

WOUND FROM SPECTACLE LENS.—Serious injury to the eye from the breaking of a spectacle glass is rare. But one is recorded by Zimmerman (see p. 188), and another by Mitchell. In the latter a clear cut 7 or 8 mm. long was

made through the cornea from the center upward and outward. The iris was not incarcerated but became adherent to the cornea; and two months later acute secondary glaucoma developed. A large iridectomy and breaking up of all anterior synechias with a spatula gave relief.

TREATMENT OF INFECTED WOUNDS.—The thorough cauterization of infected penetrating wounds of the eye, as advocated by Van Milligen, is a measure that deserves a more general trial. All the cases so far reported as having been subjected to it seem to have done remarkably well. Zentmayer reports a case of the kind in which enucleation had been decided on. The entire cornea was infiltrated with pus, and purulent vitreous extruded from the sclero-corneal wound. The wound was cauterized to the depth of 5 mm., a Saemisch incision done on the cornea, and iodoform introduced within the eye-ball. Next day the eye looked much improved, and a few months later remained quite free from hyperemia, with normal tension.

Claiborne and Coburn, experimenting on rabbits, found that formalin, 1:500, could be injected into the vitreous without causing more than a momentary disturbance, but the solutions of half this strength exerted no influence on staphylococcus infections of the vitreous. They favor the treatment of commencing infections by injections of such solution (1:500) into the capsule of Tenon.

ORBITAL WOUND DIVIDING OPTIC NERVE.—Parsons reports a case of stab wound of the orbit apparently dividing the optic nerve, and collects the cases of this character previously reported. In his case the appearances of the fundus of the eye were those of retinal embolism. They are shown in Fig. 44. The vessels were of good size, both arteries and veins were of the normal color of the veins, and by moderate pressure on the eye-ball they could be emptied. The intra-ocular tension was greatly increased at first, and then steadily diminished. The pupil dilated but retained some consensual reaction. The cornea was insensitive. In the main these are the symptoms that have been observed in other

cases. The edema of the retina is attended with considerable swelling, possibly in some cases with detachment. This may account for the absence of any cherry red spot at the

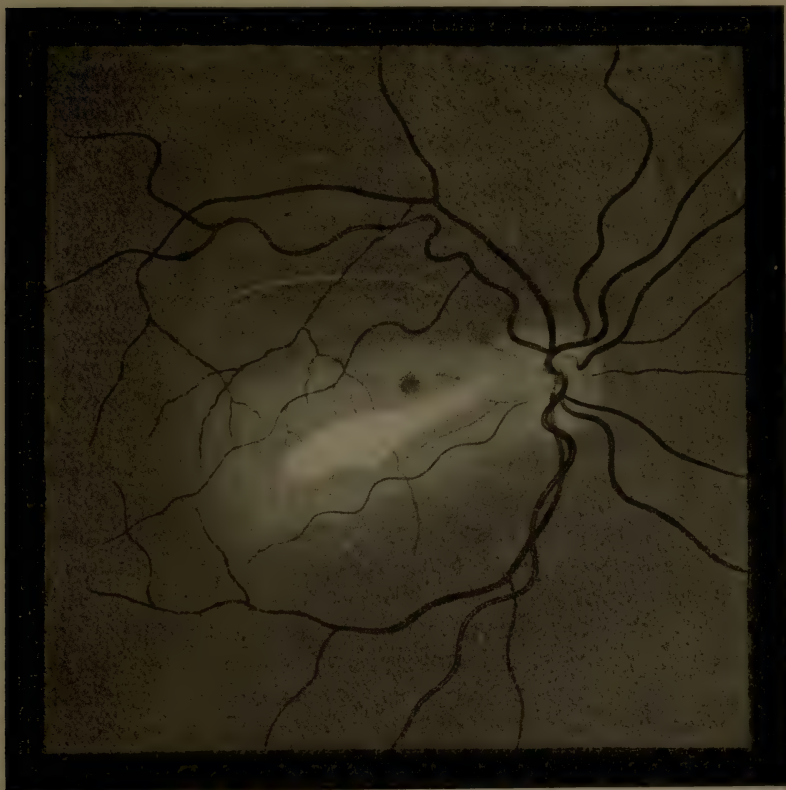


Fig. 44.—Parson's Case of Division of the Optic Nerve by Stab Wound of the Orbit.

fovea. Five months afterward the cornea was still anesthetic, the pupil immobile and four mm. in diameter, the optic disk chalky white, the retinal vessels rather small, the retina much degenerated, and the tension normal.

EVULSION OF THE OPTIC NERVE.—A case of dragging of the nerve out of the sclera is reported by Salzmann. In place

of the optic disk a deep hole was seen with the ophthalmoscope, the floor of which changed from dark red to gray. The retinal vessels regained their color and calibre in about 2 weeks. The hole seemed to fill from the bottom and to contract. Injuries of this kind occur from gunshot wound, as in Salzmänn's case; or from the thrusting of a blunt body, as a cow's horn, into the orbit. Eight cases have thus far been recorded.

Foreign Bodies

X-RAY LOCALIZATION OF A FOREIGN BODY.—The general principle that treatment should be based on the best obtainable knowledge of the case, applies as forcibly to the removal of foreign bodies lodged in or near the eye-ball as to any other surgical operation. We are often compelled to act with very imperfect knowledge—the apparatus which might give valuable information is not available, or for some reason may fail to give the assistance expected of it. But these difficulties constitute no excuse for not obtaining more exact information whenever it can be obtained. There is no doubt about the possible value of methods for the exact localization of foreign bodies in or about the eye, and no doubt that such methods are too much neglected. This gives papers like that of Deane, on the localization of foreign bodies in the eye and their removal, an especial value. He employs a modified form of the localizer of Mackenzie Davidson.

In one of Deane's cases two shot had penetrated the eye-ball. But the radiograms obtained demonstrated that they had both passed out of the eye again, and were harmlessly lodged in the cavity of the orbit. Cases of such double perforation of the eye have been reported by Seggel and Hirschberg within the past year. And Hirschberg—he of the magnet and the sideroscope—laments that no pathognomonic sign of such passage of a foreign body out of the eye-ball exists.

In another of Deane's cases the giant magnet had been tried and had given no positive evidence of a foreign body. The localizer showed exactly where it was, so that a scleral incision was made directly upon it, and it was extracted without difficulty, altho embedded in the choroid.

Fisher says: "An X-ray picture only causes delay, and this favors infection." But on the next page he refers to the danger of a scleral opening (being ignorant of the location of the foreign body), also to the danger of wounding the lens. Then he says: "Not being able to estimate the size of the metal, we must take some chances." This simply means that the patient is compelled to take some extra chances because he has selected a surgeon who does not observe the general principle above stated. Let us freely admit that there are resources which we cannot always command for our patients, without attempting to belittle the importance of the methods which we can not use. There is a great deal of truth in Deane's remark: "It must be said of many advocates of the giant magnet that they begin their work of extraction without exact knowledge of the position or size of the substance they are about to remove."

MAGNET EXTRACTION.—The large number of cases reported during the year bring out very little that is new. One case recorded by Fehr illustrates the difficulty of extracting small particles, and the value of careful persistence in the attempt. A particle of steel entered through the sclera, six mm. from the corneal margin, and could be seen hanging in the vitreous, 8 diopters in front of the retina. The first attempt at magnet extraction was made $1\frac{1}{2}$ hours after the injury. Four days later Volkmann, with his largest magnet, failed to dislodge it. In brief, on the seventeenth day from the injury, the eleventh attempt at extraction was successful. The dimensions of the particle were $1.25 \times .8 \times .2$ mm. and its weight 1 milligram. Fehr believes that the repeated attempts had a tendency to disengage the splinter from the blood clot in which it was entangled; and rendered possible the ultimate success.

Using Haab's giant magnet, Connor and Lang have each encountered difficulty from getting the foreign body entangled in the posterior surface of the iris, and have overcome it in much the same way. Connor introduced a strabismus hook and carried the point back of the iris, in contact with the foreign body. Connecting this with the magnet and slowly turning on the current, the splinter was seen to attach itself to the point of the hook and was readily withdrawn from the wound. Lang employs in the same way a steel spatula, which he connects with the magnet by a few strands of soft iron wire, about 12 inches in length twisted into a little rope.

FOREIGN BODIES OTHER THAN IRON.—Zimmerman reports a group of cases in which the eye was injured, with the introduction of a foreign substance not suitable for removal by the magnet. One of these was a small fragment of brass or copper resting in the vitreous just behind the crystalline lens. It had been retained 14 years, without creating any disturbance, and with only very slight downward displacement in the vitreous. A few very fine vitreous opacities were present, but the eye had vision of 20/15. Zur Nedden reports a case in which a fragment of copper had been retained for 10 years; but vision was reduced to 2/7, with some choroidal atrophy and a membrane in the vitreous.

Another case reported by Zimmerman is one of a wound of the eye by a fragment of glass, in which careful examination failed to reveal the presence of any foreign body. But six days later a splinter of glass 7.5 mm. long was found in the conjunctival sac, apparently having been extruded from the vitreous.

Sympathetic Disease

THEORIES OF PATHOLOGY.—Romer, from his extended study of the subject, concludes that the only conceivable paths of propagation from one eye to the other are the lymph channels of the optic nerve, and through the blood by the general circulation. What he regards as the characteristics of the exciting agent are, its ability to remain potent in the eye or in the body for a long period, and inability to harm other organs. He is inclined to think that it is carried by the blood. The elaborate investigations of Stoeck upon endogenous infection seem to show quite clearly the possibilities of metastasis through the general circulation; and certainly the weight of evidence is now in favor of this path.

For 20 years the best investigators have worked industriously to demonstrate the parasitic nature of sympathetic inflammation. But aside from their utter inability to discover any specific organism, some characteristics of the disease do not conform wholly to our general knowledge of infections. Sympathetic irritation is left unexplained by that hypothesis; and an important group of cases in which, without sympathetic inflammation or irritation, a damaged eye appears to exert some injurious influence upon its fellow, also remains unaccounted for.

In view of this a suggestion made by Brown Pusey seems extremely promising and important. He calls attention to the experimental work of Castaigne and Rathery upon the kidneys. They found upon ligation of the ureter and vessels of one kidney, allowing it to remain in the body and undergo degenerative changes, that degenerative changes also occurred in the other kidney. But that these changes did not occur in the second kidney when the first kidney had been excised. The supposition is that the cells of the damaged kidney produce toxins (cytotoxins) directly harmful to the cells of the fellow kidney, which they reach through the circulation, or the damaged cells may excite in the blood changes which make

it antagonistic to kidney cells, causing the damage or destruction found in the otherwise healthy kidney.

Pusey suggests that the same thing may occur with the eye. Cytotoxins, produced in the damaged uveal tract of one eye, may act upon the cells of the uveal tract in the other eye, either directly or through the changes they excite in the blood; and thus produce disease in the sympathizing eye. He attempted to obtain experimental confirmation of this view by injecting an emulsion from the eyes of dogs into a goat, and then injecting serum from the goat into other dogs. The result of his experiments was negative. But this only leaves his hypothesis exactly on the same plane as all the older ones. Pusey's theory is broad enough to cover the irregular forms of sympathetic disease.

Abadie reports two cases of what he regards as a special form characterized by extreme slowness of onset and mildness. This he calls chronic infective sympathetic ophthalmia. He thinks it in some way connected with the existence of an unhealthy scar in the exciting eye, through which micro-organisms may enter.

PREVENTION OF SYMPATHETIC OPHTHALMITIS.—Dianoux has obtained the views of his colleagues, de Wecker, Galezowski, Dor, Badal, de Lapersonne, Truc, Trousseau and Valude, as to the prophylactic value of enucleation. None of these ophthalmologists of enormous experience have ever seen sympathetic inflammation after enucleation, altho they have seen it occur after some of the substitutes for enucleation. Dianoux has had the same experience.

OPERATIONS ON EYES BLIND FROM SYMPATHETIC OPHTHALMITIS.—The temptation to undertake such operations is often very great. But many of them result disastrously. Browne and Stevenson, reasoning that this unfavorable course was due to the existence in the eye of an irritant which might be removed by irrigation, practised very free washing out of the anterior chamber with salt solution. "The irrigation was very prolonged and thorough;"

and the reaction following the operation trivial. They report two cases in which, by this method, very excellent results were obtained.

General Ophthalmology.

DEFINITION OF BLINDNESS.—Truc deplores the common uncertainty and confusion as to what constitutes blindness, and urges the importance of some exact definition for that term. Scientifically it might be held to mean absence of any light perception whatever; but for social, economic and educational purposes, many who have light perception must be counted as blind. He therefore urges that when vision cannot with either eye be brought up to one-tenth of the normal standard, the patient should be called blind.

This definition is convenient and clear, and it agrees as nearly as any, with what has been previously suggested in this connection. Thus, Magnus and Wurdemann regard blindness as complete in an economic sense when vision falls below 15/100 for occupations requiring higher visual acuity, or 5/100 for occupations requiring lower visual acuity. Of course blindness according to a single fixed standard cannot have the same significance in regard to various occupations and social relations. Truc recognizes this, and arranges three degrees of blindness: absolute, when all perception of light is lost, complete, when there remains perception of light, but not of objects; and relative, when there is some perception of form, but not enough to give useful vision. He also recognizes that the disability caused by blindness will depend somewhat upon the field of vision, and on other circumstances.

HELP FOR THE BLIND.—When we come to sum up the more important contributions of E. Javal to ophthalmic science and art, we shall find among them, those which have grown out of the forcing upon his active mind of the prob-

lems raised by his own blindness, which became complete three years ago. Here was a scientific investigator, perfectly fitted for the work, compelled to face the questions from the standpoint of a sufferer. His suggestions for those who become blind in adult life were first put forward as a preliminary paper, hoping that those who had made observations on this subject, would aid by communicating with him, and supplying material for his more complete work. The keynote to his suggestions is: *Lessen the dependence of the blind man upon others!* He feels dependence to be his chief burden. He points out to his brother oculists their duty not to encourage false hopes of recovery by the use of strychnia, electricity, etc.; but to urge the patient suffering from progressive disease, to use what sight remains in preparing for the total loss which is to come. It may be remembered, too, that the devoted relatives of a blind man may do too much for him. Their aim should be to secure his liberty and independence, by aiding him to do for himself all that is possible.

Javal does not find that the loss of one sense leads to the further development of others. But the blind man may learn to notice sensory impressions that commonly escape the seeing person, and to interpret them with greater skill. To aid his use of hearing, useless sounds should be excluded. A window open to the street may prevent hearing footsteps in the house, or the striking of a clock, or the exit or entrance of a friend. General conversation is confusing.

To develop the power of judging direction by hearing and of noting the peculiarities of different voices frequent visits to the theatre are recommended. The sense of smell is most serviceable to those who abstain from smoking and snuff-taking. But *touch is of paramount importance*. A stick or light cane extends its range. It is the antenna of the blind. Javal recommends having it constantly at hand, suspended by a cord 20 cm. long, attached the same distance from the knob of the cane, and supported by a hook or button from the buttonhole of the coat. Thus it is at the disposal of either hand, and needs to be detached only for walking.

The "*sense of obstacles*" is a faculty possessed only by those who have been blind from childhood. It is referred usually to the forehead and temples, never to the hands. It enables blind children to walk, even in unfamiliar places, without coming in contact with objects. In passing a house front they can count the open windows. They recognize whether a door in front is open or shut. It has been referred to air pressure, but appears to be keenest when the approach is slow. It may depend partly on hearing, but in some cases is not impaired by general noise. Javal suggests that it may have some connection with invisible rays. By learning of its nature we may learn how to develop it.

A blind man's dependence will be least when in a *habitation* with which he is perfectly familiar. Javal advised a patient threatened with blindness to acquire the ownership of the house in which he lived. "A place for every thing and every thing in its place" concerns the blind above all others. Books, papers and articles of furniture should be scrupulously kept in their accustomed positions. Special strips of carpet may serve as land marks in a large house. There should be a smooth path for a free promenade in the garden.

In *walking abroad* the guide should give his arm, and thus be slightly in advance of his charge. When the foot must be raised, the forearm may be raised sharply, as a signal. To step down, the forearm can be pressed to the side. To protect from some one coming toward them, the guide should step somewhat in advance. When several persons act as guides at different times, they should, as far as possible, adopt the same system of signals. Dark glasses may be worn, both to hide disfigurement of the eyes, and to intimate the disability to others. In narrow places and on the mountain side, a stick held horizontally between the two is better than the hand or the arm of the guide.

Javal refers to the special need for *active exercise* on the part of the blind, because they do not make the frequent movements of rising to fetch things, or stooping to pick them up, or turning the head and body when speaking to others.

Such movements furnish some exercise to those who can see, even tho their occupation be sedentary. He speaks with high appreciation of the tandem tricycle. With a trustworthy companion, one may get exhilarating exercise without the preoccupation that necessarily attends walking.

With regard to *writing*: Those who have learned the art of writing in the ordinary way before going blind, should not be permitted to lose it. Javal has invented a writing board in which the elbow lies in a metal pocket, furnishing a fixed point, around which the hand moves in the arc of a circle. The position of the paper is regulated by a series of notches by which the writer, after finishing one line, can move the paper for the proper position for the next. He uses a stylographic pen; and tests if the ink is flowing freely by drawing it across a roll of tissue paper, which when wetted will tear with the slightest pull.

By this method Javal can write 25 words per minute. But of course he cannot read what he has written. On the other hand, by the Braille method he can read what is written, but can only write 4 words per minute. An expert in that method can only write 8 or 10 words per minute. The *type writing machine* can of course be used by the blind; and Javal suggests that by having the Braille letters gummed to the keys, the use of a machine can readily be learned by those familiar with the perforated letters.

He makes the very important suggestion that a writing machine should be devised which would print both the ordinary and the Braille letters, the one over the other. With such a machine the blind could write a letter for the seeing to read; and yet could himself read what he had written. On the other hand, any one could write what the blind would be able to read. The time saved by such a machine would also be very important, since a skilled operator can write 40 or more words per minute. In reading, the blind would still be at some disadvantage. A good reader can read to himself 400 or 500 words per minute, and can read 100 to 200 aloud. In the Braille letters Javal can read 20

words per minute. Experts attain 60 to 100, and one person is mentioned by whom 200 words a minute could be read.

To convey information to the blind by means of *charts*, Javal has employed sheet wax upon which wire can be laid to produce lines; different kinds of wire can be used to produce lines of different significance. He also mentions the employment of cotton threads covered with wax.

To ascertain time there are available, special watches for the blind; and this method is suggested, which any one may find convenient in the dark. An ordinary watch is wound slowly and the number of clicks counted. The number of clicks in the winding of the watch for twenty-four hours is divided into the number of minutes in 24 hours, thus giving the number of minutes corresponding to each click. To ascertain the time, then, it is only necessary to know at what hour the watch was last fully wound, wind it up again slowly, and count the clicks. Adding the minutes represented to the time when last wound will give the time quite accurately. In the presence of a stranger, when he does not wish to consult his watch, Javal measures time by means of his cigar.

In regard to *meal times*, there are many things that can be done to lessen the dependence of the blind. A knot tied in the corner of his napkin and pushed well within the shirt collar, will let the blind man know if the napkin slips out of place. Soup can be taken by tilting his spoon a little each time to prevent its being overfull. Wine may be poured into a glass by placing the finger of the other hand on the rim of the glass, etc. But certain things, as putting mustard properly on meat, are impossible and should not be attempted. Javal refers with feeling, to meal times as an opportunity for social intercourse; and to the complete dependence of the blind man at other times, upon those who especially seek him for that purpose.

AMBER YELLOW GLASS.—Seabrook, believing that glass of this color best protects the eye from both heat and chemic rays, has made various applications of it in ophthalmology. A plate of it was introduced between the two halves of a

biconvex lens to be used in examining the eye by oblique illumination. With this the examination seems to cause less lacrimation, photophobia and pain. The change of color it produced proved at first somewhat confusing. He also tested the effect of such glass upon the acuteness of vision. In 60 per cent this remained unchanged, in 35 per cent it seemed improved, and in 5 per cent diminished, and he thinks the diminution may be accounted for by a larger pupil. The protection of eyes by such glasses, in cases of hyperesthesia of the retina in glaucoma and tobacco amblyopia, seemed to afford considerable relief, when smoked glasses did not.

RADIUM AND ULTRA VIOLET RAYS.—London has investigated the properties of the radium rays with regard to vision. He finds that at a considerable distance they can excite the retina, giving a general sensation of light. But their influence does not increase the visual acuteness for light rays. The radium rays are not refracted, reflected or, to a material degree, absorbed by the refractive media of the eye. If their influence be too strong or too long continued they may cause keratitis, retinitis, or even atrophy of the eye-ball. They are able also to exert a direct influence upon the visual centers. They penetrate freely to the retina in spite of opacities or extreme coverings. To be able to discriminate thus, between blindness due to disease of the retina, and that due to disease of the media of the eye is a step forward in ophthalmic diagnosis.

Experimenting with the ultra-violet or chemic rays, Strobel found that the media of the eye allow them free passage. It is possible with them to induce a circumscribed inflammation of the retina. Under their influence the iris became hyperemic, inflamed and pigmented. But the iris is able to exclude their influence from the deeper tissues.

APPEARANCE OF FUNDUS BY THE MERCURY LAMP.—The constant electric current passing through a vacuum tube containing mercurial vapor, gives a brilliant light almost devoid of red rays. Mayou reports that, seen by this light,

the general color of the fundus is green—the optic disk has a white center with green edges. The retinal vessels are purple, the choroidal vessels a deeper purple. A retinal reflex is seen over the whole fundus. It is most marked along the vessels, and is rather indefinite at the macula. A better perspective of the fundus is gained, the different depths of the retina, choroid and sclera being more evident. Mayou thinks this light may prove of much use in the differential diagnosis of retinal and choroidal disease.

DEMONSTRATING OPHTHALMOSCOPE.—Sailer has utilized the principle of partial reflection at the surface of a piece of plane glass to secure multiple images, by which a demonstrator and three students can simultaneously view the fundus in the inverted image, while the demonstrator can control the direction of the patient's eye.

METHYL-ATROPIN.—Wieselmann, experimenting with solutions of the bromid of this new mydriatic, finds that the dilatation of the pupil it produces when used in $\frac{1}{2}$ per cent solution does not last over 24 hours. The addition of cocaine to the solution causes it to act more rapidly, and also to produce greater disturbance of accommodation. He believes that the $\frac{1}{2}$ per cent solution without the addition of cocaine will render the best service. It seems to offer no advantages over ephedrin, or weak solutions of homatropin and cocaine.

YOHIMBIN.—This is an alkaloid produced from yumbeton bark. It is found by Magnani and Salomonskin to be an efficient local anesthetic. The 1 per cent solution dropped into the eye causes some smarting and hyperemia of the conjunctiva. Anesthesia is complete before 10 minutes, and lasts about one-half hour. No effect is produced on the accommodation. Magnani has also used it successfully to produce local anesthesia by subcutaneous injection. These observations have been, in the main, confirmed by Loewy and Mueller. The irritation it causes, and the high price of the drug, will probably prevent it from displacing the local anesthetics now in use, unless it offers some advantage not yet demonstrated.

PROTARGOL STAINING.—The comparatively slight irritation produced by the organic silver compounds is likely to lead to a more general and prolonged use of them without skilled supervision, than was ever accorded to silver nitrate. In view of this it is proper to emphasize the fact that they can produce the same kind of staining as the older silver salt. I have seen one case in which a decided brown stain of the conjunctiva was produced by protargol, which the patient continued to use for several months for dacryocystitis. De Schweinitz reports a case in which, after the use of a protargol solution for eight months, he excised the lacrimal sac. It was very darkly stained; and he was able, in microscopic sections, to demonstrate the deposit in the walls of the sac.

GENERAL OPERATIVE MEASURES

BALANCE FOR KNIFE TESTING.—A simple balance consisting of a rule supported at the center, with a weight that can be slid along upon it, has been devised by Priestley Smith for knife testing. The drum for testing is placed on one end of the balance; flat to test the force required to puncture it, and laid on the side to test the pressure necessary to make a cut. In this way the relative sharpness of different knives can be ascertained; or the effect upon their edges of disinfection by heat or other means may be accurately studied.

FIXING THE EYE WITH SUTURES.—Thompson having encountered great difficulty of fixation in a case of cataract extraction, met it by introducing two double silk sutures about 2 mm., from the corneal margin, at each end of the horizontal meridian. These being held by an assistant gave good control of the eye, without causing the same tendency to gaping of the wound as ordinary fixation by forceps.

SKIN GRAFTING.—The tendency of the epithelial (Thiersch) skin graft to roll upon itself at the edges, and thus interfere with perfect coaptation, is well known. To overcome it, Buller spreads the graft carefully upon the sticky surface of ordinary isinglass plaster. Then it may be

trimmed to the exact size and shape desired, and can be placed upon the bed prepared for it in exact apposition with its surface. Grafts carefully applied in this way all survived and adhered perfectly to the surface.

USE OF PARAFFIN FOR PROTHESIS.—The formation of a stump by injecting paraffin into the capsule of Tenon, after enucleation of the eye-ball, has been tried by Ramsay in 34 cases. Three times the paraffin came out because of inefficiency of the stitching. But 2 of these were among his first three cases, before he had adopted the purse suture. In a third case a stitch holding one of the muscles broke. In a fourth case the paraffin remained exposed at one point for six months; when it was shelled out through a slit made for the purpose, on account of the patient's complaint of pain. In one case, also, the stitches were loosened, and the paraffin allowed to escape, on account of severe inflammatory reaction following the enucleation of a suppurating eye-ball. Ramsay states as the chief advantage from the operation, the minimizing of the flat sunken appearance of the upper lid, that follows simple enucleation.

Ramsay's method is to divide the conjunctiva as close to the cornea as possible, raise each rectus on a strabismus hook, and pass through its tendon and the over-lying conjunctiva a strand of catgut, knotted at one end to prevent slipping. The recti tendons are then divided at their insertions and the enucleation completed, with special care not to injure the capsule of Tenon. Hemorrhage is checked by hot water; and the capsule of Tenon, being held open by the tendon sutures, is packed with gauze moistened with adrenalin. Then a strong black silk purse-string suture is passed around the mouth. The packing is then removed, the nozzle of the syringe inserted, and the purse suture drawn tightly around it. The paraffin is injected until it distends the sac. The nozzle is then withdrawn; and the purse suture quickly tightened, and tied with a double knot. The sutures of the opposing recti are then tied across the opening. Any excess of paraffin is wiped away and the con-

junctival sac bathed with a boric solution and a compress and bandage applied. For several days afterward the eye is douched with a hot solution of trikresol, 1:1000. The suture is removed at the end of a fortnight; and three or four weeks later an artificial eye can be adjusted.

Oatman injected the paraffin into the scleral cavity in Mules' operation, instead of using a glass or metal ball. The advantage he claims for this is, that if the paraffin should become exposed a part of it could be removed and the tissues made to unite over the remainder, affording a good stump. Whereas the glass ball, becoming exposed, cannot be reduced in size, and has to come out.

Hertel has made an experimental study of paraffin prothesis in rabbits. He attempted, after enucleation and healing of the wound, to form a stump by the injection of paraffin into the tissue. With paraffin melting at 104° F. these efforts resulted in uniform failure. But using a ball of paraffin having a melting point of 172° F. and inserting it into the capsule of Tenon after enucleation, very satisfactory results were attained; except in one case in which enucleation was done during panophthalmitis. An anatomical examination of the part 12 or 15 months afterwards seemed to indicate some invasion of the paraffin masses by the surrounding tissues. Less of this tendency was shown with the hard paraffin. Ramsay, in the case in which he removed the paraffin found, on microscopic examination, no evidence of incorporation with the structures surrounding it.

Paraffin injections cannot be regarded as wholly free from danger. Hurd and Holden have reported a case in which blindness from retinal embolism came on during the injection of "white vaseline" to improve the form of the nose. Attending ecchymosis indicated that a vein had been punctured. Two of Hertel's rabbits died of pulmonary "fat embolism." He thinks the danger of embolism greater with paraffin having a low melting point. In Hurd and Holden's case the melting point was 110° F. Ramsay used a paraffin with a melting point of 104° . But in Ramsay's method of

operating, injecting the paraffin into an open space, after all bleeding has been checked, such an accident as its introduction into a vein is scarcely possible.

OPERATION TO SECURE A SULCUS FOR PROTHESIS.—To enlarge a socket and fit it to hold an artificial eye, Maxwell has turned in a piece of skin from the cheek, somewhat after the manner of Harlan's operation for symblepharon. In-

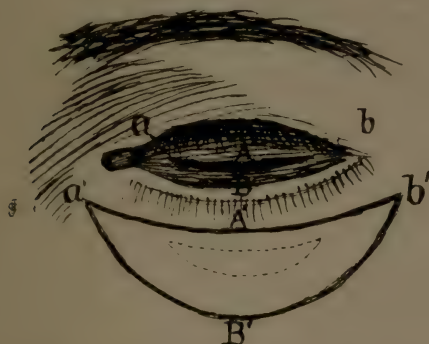


Fig. 45—Maxwell's Operation to Enlarge the Socket.

cisions are made through the skin, as shown in Fig. 43 a' , A' , b' , and a' , B' , b' . The piece thus included is dissected up from the subcutaneous tissue, except the central area indicated by the dotted line. The incision a' , A' , b' , is carried in until it meets an incision behind the lid, made from the socket. The flap is pushed through this incision into the socket and sutured to corresponding points; a' to a , A' to A , b' to b , and B' to B .

The margins of the space thus left bare on the cheek are then brought together, B' to A' , care being taken to bring the lower and longer curve to the shorter one as accurately as possible, and without puckering. The width of flap recommended is 8 mm., and its upper margin should be 5 mm. below the margin of the lid. To get a good result the incision in the socket must be as long as the space will permit, and the skin flap considerably longer than this. The portion

of it not dissected up (included in the dotted line) should be as long as the incision in the socket.

OBLITERATION OF THE SOCKET.—Alt calls attention to an operation, originally proposed by John Green; which he has performed in seven cases, and always with a result most gratifying to the patient and to himself. In cases of malignant tumor affecting the lid margins and eye-ball it is especially appropriate. It may also be practiced for certain orbital tumors which are not apt to recur, and which are removed with the eye-ball. The method is, after enucleation of the eye-ball, to draw forth the tarsal tissue and conjunctiva by means of forceps, to cut it off from the muscular and cutaneous portions of the lids, and then to excise the lid margins so as to remove all the lashes. Finally the cut edges of the lids are adapted to each other, and carefully stitched together. There results a perfect cutaneous surface with a barely perceptible linear scar. The appearance of the parts after this operation is far better than one might expect it to be. The freedom from secretion and continued irritation thus secured, Alt thinks, would be better for most working people than the wearing of an artificial eye,

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